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GEOLOGY 14

GEOLOGY OF THE LONG LAKE QUADRANGLE

BY

H. P. CUSHING

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New York State Education Department
Science Division, October 19, 1906

Hon. Andrew S. Draper LL.D.
Commissioner of Education

SIR: I beg to communicate herewith, for publication as a bulletin of the State Museum, an account of the geology of the Adirondack region known as the Long Lake quadrangle accompanied by a geological map on the scale of 1 mile to the inch, both of which have been prepared by Prof. H. P. Cushing.

Very respectfully
JOHN M. CLARKE
Director

Approved for publication this 20th day of October 1906

A. S. Draper

Commissioner of Education

New York State Education Department

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ACKNOWLEDGMENT

A portion of the field work, on which the following report is based, was done in conjunction with the topographers of the United States Geological Survey, while they were mapping the district. In country of this kind, where accurate location of outcrops is by no means the least of the difficulties under which the geologist labors, combined work of the sort is highly advantageous, since the topographer locates the geologist's outcrops for him, and that with a high degree of accuracy. The arrangement was highly advantageous to the State Museum, as well as to the writer, and he wishes to express his hearty acknowledgments to Mr H. M. Wilson, whose permission made the arrangement possible, and to Mr J. M. Whitman jr, and Mr A. P. Meade jr, for a vast number of courtesies, and a very helpful and pleasant field season.

SITUATION AND CHARACTER

The Long Lake quadrangle comprises that part of the Adirondack region lying between parallels 44° and 44° 15′ n. latitude, and meridians 74° 15′ and 74° 30′ w. longitude, its area being slightly over 218 square miles. If the Adirondack region is understood to comprise the entire district of the north woods, then this quadrangle lies about midway, or in the heart of the district. It is however situated on the western border of the more rugged portion of the area, that included in the Adirondack mountains proper.

The quadrangle is noteworthy for the variety of topography presented. The main axis of elevation of the region crosses it,

and its eastern border hugs the western edge of the high Adirondacks, the Santanoni quadrangle, just east, being one of the loftiest, most rugged, and most unsettled of the whole region. The southern border of the depressed "lake belt" shows well in the northern part of the quadrangle. The northern and southern halves of the Adirondack region are of somewhat different topographic character, great igneous rock masses predominating in the former, and gneisses of various kinds in the latter, and the line of division between the two crosses the quadrangle from east to west about midway. The differences however are not as prominently brought out in the sketching, as they appear in the field.

The Raquette, one of the greatest of the Adirondack streams, runs across the quadrangle, Long lake being merely a somewhat widened and perhaps deepened portion of the stream, which enters it at one end and leaves it at the other. The great reach from Raquette falls to Piercefield, not far beyond the map limits to the west, is the longest possessed by any Adirondack stream. The rapids at Raquette falls are the only interruption to navigation on the river which are found within the map limits.

The quadrangle is also nicely illustrative of the number and variety of the Adirondack lakes and ponds, 57 of which are found, in whole or in part, within its borders. Three of the larger lakes of the region, Big Tupper, Upper Saranac and Long lakes, are shown in part, somewhat over half the length, and all the wider part of Long lake being included. Of those wholly within the area of the map, Follensby pond is the largest, followed in order by Catlin lake, and Big Simons and Jenkins ponds, with thence a regular downward gradation to ponds so small as to make little showing on a map of this scale. In elevation of mean water level they range from the 1534 feet of Big Tupper and Big Simons, to the 2050 feet of Seward pond. Some of them are rock bound, in whole or part, with frequent rock islands; others have low shores of morainic material or of sand. Many of these latter are exceedingly shallow and are being rapidly converted into marshes. The extent of this conversion is well brought out on the map in several instances, as in the case of Pickwacket pond, in the extreme southeast portion of the quadrangle, and of Pickerel pond, 2 miles south of east of Axton. The Tupper Lake reservoir is simply a dredged out portion of what was a nearly marsh-filled lake basin.

With its frequent lakes, the long reach of the Raquette river

with its bordering swamps and cut-off oxbows, the broad belt of lowland separating the highlands of the north from those of the south part of the quadrangle, and the difference in character of those two highland areas, the quadrangle shows a diversity of topography rather unusual, even for an Adirondack map sheet.

Practically the entire area was forest covered until recently, and most of it is yet thus covered, though with a sadly changed forest. The rapid growth of the village of Tupper Lake, especially as a lumber center, has resulted in a steady increase in the amount of cleared land in its vicinity, and within the past 15 years the removal of the timber from the district has been rapid. The ordinary wasteful lumbering of the conifers (and much of the lumbering in the district has been of that type) is bad enough. But in addition a vast amount of small wood for paper pulp has recently been cut, and also much hard wood, so that there is now a wide area in the northern part of the quadrangle and thence northward for many miles, which has been practically deforested, and through which the great forest fires of May 1904 ran widely. Here as elsewhere, the Adirondack forest is disappearing, and much of it disappearing in such wise that reforestation will be a difficult, if not impossible matter.

GENERAL GEOLOGY

With the exception of the very recent, unconsolidated surface deposits, all the rocks found within the limits of the quadrangle are of Precambric age, or belong to the oldest known, great rock group. The length of that part of the earth's history which these rocks record is not known, either absolutely or relatively, but it is known that the lapse of time involved is exceedingly great, and it is quite probable that 50% or more of the entire geologic history of the earth is included. Furthermore most of the Adirondack rocks are of early Precambric age, or were formed during the first half of this long time interval. They are hence to be classed as among the earliest of the known rocks of the earth.

There are at least four great groups of these Precambric rocks, and their relations to one another are, for the most part, known. Unquestionably these groups are more or less capable of minor subdivision, but comparatively slight progress has yet been made in this direction. The study and interpretation of the history which these rocks imperfectly record is a matter of extreme difficulty, because the rocks have been profoundly modified, both

texturally and structurally, by action of great compressive forces, so much so that many of them have lost all trace of their original character. These four groups are.

1 A series of old sedimentary rocks, the Grenville series, much involved with igneous rocks some of which seem of approximately the same age.

2 A series of gneisses which seem to be mainly or wholly of igneous origin, which may be, in part, older than the Grenville rocks, though no certain evidence of this has yet been forthcoming in the Adirondack region. If there are in the region any exposed rocks more ancient than the Grenville rocks, they are here.

3 A series of igneous rocks, usually in great masses (batholites), which are demonstrably younger than both the preceding, and which are not so profoundly changed in character, retaining often traces of their original textures and structures.

4 A series of very much younger igneous rocks which have undergone little change since their intrusion.

Rocks belonging to all four of these groups are found within the area of the Long Lake quadrangle, and all but the last have an extensive representation, the quadrangle being rather unusual in this respect.

Grenville series. Here are classed certain well banded gneisses and schists, some of them very quartzose and grading into quartzites, with bands of varying thickness of coarsely crystalline limestone. They are believed to be old water-deposited rocks, ancient sheets of sand, mud and calcareous mud deposited on the floor of some large body of shallow water, in all probability the sea. There is apparently a great thickness of these rocks, but neither their base nor summit is known, and they are so disturbed, and usually so poorly exposed that our ideas concerning their thickness are of the vaguest. They must have been deposited upon a floor of older rocks, but we are at present ignorant as to what these rocks were, and whether or not they are anywhere exposed in the district.

Because of the thickness and the frequent changes in the character of the deposit it is certain that the deposition of these rocks took a long time, pointing to a protracted submergence of the area at this early day, with frequent relative oscillations of the land and water levels. The close association of igneous rocks with them, some at least of which seem only found in this association, is thought to point to closely contemporaneous igneous action on a large scale.

Doubtful gneisses. Here are classed other rocks, differing from the preceding in that they seem to be wholly of igneous origin. They have been equally, if not more, changed from their original condition than have the rocks of the preceding group, and all traces of their original characters have disappeared. Similar rocks, in general not to be distinguished from them, occur associated with the sediments, where they are clearly as young, or younger than they are. So these may represent great masses of such rocks, massed in such amount as to have wholly displaced the sediments. On the other hand they may be, in part, older and represent the rocks of the floor on which the sediments were deposited. The question is, as yet, undecided; the former is the more probable.

Great igneous intrusions. The rocks of the two preceding series at present found in the district constitute only a fragmentary remnant of those formed at this early time. They have suffered large loss from above by surface wear, slow but long continued. They have likely also suffered loss from beneath owing to the attack of masses of igneous rocks which were working their way upward. Prior to the appearance of these intrusions the older rocks seem to have suffered compression and as a result to have been much changed in character. At the time of compression they must have been buried under a considerable load of overlying rock, the great masses of the intrusions solidified under large load, and both are now at the surface because of the removal of this overlying rock during long ages of surface erosion. The intrusive rocks invaded the entire district, but Essex and southern Franklin counties felt the full force of the invasion, these igneous rocks forming most of the present surface there, while elsewhere they are not as prominent.

These igneous rocks may be grouped into four great classes, anorthosites, syenites, granites and gabbros, all no doubt derived from some great parent molten mass beneath by some process of differentiation. The anorthosite intrusion was the first and bulkiest, forms the heart of the igneous district, and was followed by smaller and more scattered intrusions of syenite, of granite and of gabbro.

These rocks have also been profoundly modified by the action of great compressive forces, while deeply buried, but are not so thoroughly changed in character as the earlier rocks, retaining many traces of their original structures.

Following this time of igneous intrusion the region seems to have been a land area for long ages and to have undergone a prodigious

amount of surface wear during the interval. The thickness of rock removed is purely conjectural but must have been large, several thousand feet at least.

Later igneous rocks. Toward the close of this long erosion period came another time of igneous activity in the region, molten rock ascending toward the surface, and utilizing a system of east-west fissures for its ascent. Such lava-filled fissures are known as dikes, and such dikes are very numerous in the northeastern Adirondack region, though rather uncommon in the district under consideration. There was likely volcanic action at the surface, but this can only be conjectured since no known vestige of that surface now remains, all having been since worn away. The source of the material is equally conjectural, though quite likely the same as that whence the great intrusions sprang. At the present surface we see only the old, lava-filled channels of ascent.

Erosion still continuing after the close of the igneous activity, the surface was still further lowered, but by an amount to be measured in hundreds rather than thousands of feet, the character of the dike rocks clearly indicating that they solidified at no great depth.

Paleozoic submergence. Around the borders of the Adirondack region we find, resting upon the Precambric rocks, a series of sandstones, limestones and shales of early Paleozoic age, the Potsdam sandstone of Cambric age beneath, and above in order the Beekmantown dolomites and limestone, the Chazy, Lowville, Black River and Trenton limestones, and the Utica shale, all of Lower Siluric age. In the heart of the region such rocks are wholly absent, save as scattered glacial boulders. Yet nothing is more certain than that they formerly extended over much of, if not over the entire, Adirondacks. When the submergence beneath the waters of the sea began, the region had been worn down to a comparatively smooth surface by long-continued erosion, and seems to have had a low, domelike summit in the present southwestern part of the region, whence it sloped gently away on all sides. The encroachment of the sea was not steady but in oscillatory fashion, but was in general progressive; in other words the waters of the successive seas usually covered a larger part of the dome than their predecessors had done. This was especially true in the northeastern part of the district. Where we today find the Paleozoic rocks we can be sure that the sea was present, but since

they have been worn away from most of the region, the extent of the various seas is highly conjectural. It is quite unlikely that deposits of Potsdam age were ever laid down within the area of the Long Lake quadrangle. But the Beekmantown waters may have reached the district, it is quite likely that the Chazy waters did, and that deposits of Trenton and Utica age were laid down here is highly probable. The thickness which such deposits may have attained here can only be guessed at, but may well have amounted to several hundred feet.

Subsequent history. At the close of the Lower Siluric the sea disappeared from the region and there is no evidence that it has since been submerged. It has instead been a land area, its surface undergoing wear. The altitude above the sea has however been changed from time to time, and whenever it has been increased, greater capacity has been given to the eroding agents. Many millions of years have passed since the close of Lower Siluric time, no one can say just how many, and in that time every vestige of the deposits of that age has disappeared from the surface of the quadrangle, and the Precambric rocks beneath have also been eroded somewhat. What thickness of these rocks has thus been worn away can not be told, but many hundreds of feet seem to have thus disappeared from the hilltops, and from 1000 to 2000 feet more from the valleys. This is a considerable erosion, but apparently of much less magnitude than the great Precambric erosion.

At the close of the Paleozoic occurred the greatest of the Postcambric disturbances of the region. Great lines of fracture were formed, along which slipping, or faulting, of the rocks took place, along with much minor cross faulting. The great faults have a north to northeast course across the district, dividing it into a great series of slices. The cross faults more or less break these up into blocks of varying size, and at various levels. Some slight folding of the rocks also took place, but of very minor amount in comparison with the sharp folding in the New England area to the eastward, and the main displacement of the district was by faulting. Nearly all of the great faults downthrow to the east, producing a rude, steplike drop from the central area down to the Champlain valley. To the eastward, in New England, folds, and large faults which downthrow to the west, occur, resulting in the great down-faulted trough of the valley. In the Long lake area and thence

westward, faults are not so prominent as to the east, and the general altitude diminishes in that direction.

There was a minor period of igneous activity, in all probability of this date, which affected the country east and north from the Champlain valley, but not greatly to the west, and no rocks of this date are known in the area of the quadrangle. The general result of this period of disturbance was to considerably increase the altitude of the interior region.

A long period of comparative stability of level seems to have followed, sufficiently long to have permitted of the wearing down of the whole region to a rather uniform, low altitude, broad valleys with rather low, insignificant divides constituting most of the surface. Numerous hills were however left, with altitudes often several hundred feet above the general level. Following this a general increase in altitude occurred, greatest along the present main axis of elevation, and with likely renewed slipping along the faults on the Champlain side of the axis. The uplift renewed the cutting power of the streams and they excavated the present valleys of the region, the hills representing remaining portions of the previous surface. No doubt many minor changes occurred during this long period, but as mere episodes in comparison with the two greater movements.

Then followed the recent period of cold, and of ice advance over the region. How many advances and retreats of the ice sheet occurred across the Adirondacks can not be told, since the last advance obliterated all traces of its predecessors, at least no traces of them have yet been discerned. The ice plainly covered the region to a depth sufficient to submerge even the highest hill tops, and persisted for a considerable time. It did a respectable amount of erosion, and, when retreating, covered the country unevenly with glacial deposits. On its final disappearance it left the topography modified somewhat, owing both to wear and to deposit, but with its larger topographic features little changed. Ridge slopes were smoothed, summits rounded, valleys clogged with deposit, lakes produced either by inequality of deposit or by local excessive downward erosion, stream courses more or less modified, a host of minor changes in detail, much altering the general appearance of the region.

At the time of final disappearance of the ice the region had an altitude somewhat lower than at present, the amount in the quad-

rangle being some 400 feet in all probability. The altitude has since slowly increased to its present amount, and the upward movement may yet be in progress.[1]

ROCKS

With the exception of the glacial deposits and boulders, and later stream and lake accumulations, all the surface exposures occurring in the quadrangle exhibit crystalline rocks of Precambric age. These comprise not only considerable belts of the sedimentary Grenville rocks, and great batholitic masses of anorthosites, syenites, granites and gabbros, considerably younger than and intrusive into the Grenville rocks, but also large areas of gneisses, which seem for the most part igneous, which can not yet be classified, but which are, at least in part, older than the great intrusions.

Grenville rocks. The most extensive belt of Grenville rocks occurring within the quadrangle's area has its broad northern end penetrated by the upper part of Follensby pond, down whose shores it runs for ¾ mile, with greatest breadth on the west side. It extends southward from Follensby to the Moose creek valley, curving toward the southwest as it approaches it, and extends up this valley and its continuation, the Bog stream valley, to the west edge of the quadrangle.[2] As it runs west it narrows to a breadth of less than a mile, which is less than half the average breadth south from Follensby. This will hereafter be referred to as the Moose creek belt.

Another considerable belt of Grenville rocks runs west and northwest from Round island, in Long lake, past Rock pond and Grampus lake to the quadrangle edge, with an outlying small area to the south running west from Grampus lake. No trace of undoubted Grenville rocks could be discovered on the east shore of Long lake, opposite Round island, doubtful gneisses constituting that district. This will be called the Rock pond belt.

A third belt is crossed by the Raquette river just below Long lake, and extends up Cold river some 2½ miles. This very likely extends down the Raquette to a connection with the Moose creek belt, but lack of outcrops in the interval save for a few meager exposures of doubtful igneous gneisses, renders the matter uncertain. This is the Cold river belt.

There is a considerable area of Grenville rocks about the lower

1 For a fuller account of the geologic history of the region see N. Y. State Mus. Bul. 95, p. 272–94.

2 See accompanying map.

end of Lake Catlin in the extreme southeast part of the quadrangle. This is likely a northward spur of the great Grenville belt which Kemp has mapped as running east for miles along the Long Lake-Newcomb road, in the Newcomb quadrangle which corners the Long Lake quadrangle on the southeast. At the time Kemp's map was made only the actual limestones and closely associated schists were being included in the Grenville, whereas these rocks are quartz gneisses.[1]

On the Tupper Lake quadrangle, next west of the Long Lake, there is again at least one great belt of Grenville rocks, as yet unmapped, for numerous exposures of these rocks appear for several miles along that part of the Long Lake-Long Lake West road which lies between Little Tupper lake and the railroad.

In addition to these belts there are several patches of varying extent of Grenville rocks occurring within the quadrangle limits, and such as have been recognized are indicated upon the accompanying map.

As usual, most of the Grenville country is valley country, owing to the weakness of these rocks as compared with the other crystallines. In general the outcrops are infrequent, scattered and poorly exposed, so that little or nothing can be done toward deciphering the stratigraphy, or the structure. It is certain that the rocks are considerably folded, and also that the folds pitch, causing frequent changes in the direction of strike. The quartz gneisses form an exception to the general rule. Where present in considerable thickness, as they are about the lower end of Lake Catlin, they constitute respectable hills, several hundred feet in hight, on the sides of which exposures abound.

These quartz gneisses, or schists, constitute a prominent feature in the Grenville series of the quadrangle. They are metamorphosed sandstones of varying degrees of purity, and occur in part in beds of large thickness and fairly uniform character, and in part in comparatively thin beds, alternating with beds of mica gneiss and of impure limestone. These latter quartz schists are much more variable in character than are the thick ones. In general the rock is rather evenly granular, though there are all gradations between a sugary, granular, weak rock, and hard, solid, glassy quartzites. In many instances thin layers of coarse, solid quartz alternate with the granular layers, and may comprise upward of half the

1 N. Y. State Geol. 17th An. Rep't. Map opposite p. 550.

whole mass. They are however a much more prominent feature of the thinner, variable beds, than of the large masses.

All these rocks are very quartzose, but all contain feldspars in respectable amount. There are two main types of the rock mineralogically. In one a light-colored pyroxene (a white or light green diopside) is a prominent constituent, while mica (usually phlogopite) if present is subordinate; in the other the pyroxene is subordinate or fails, and mica assumes much greater prominence. The pyroxene rocks are much more apt to be granular and weakly resistant to wear, while the mica rocks are comparable to many of the igneous gneisses in resisting power, hence their tendency to form hills. Much of the rock strongly resembles quite pure quartzite, but careful inspection always shows a considerable feldspar or pyroxene content.

The larger number of the Grenville exposures in the district show a quite varying set of rocks in comparatively thin layers. The quartz pyroxene gneisses described above constitute an important feature. There are frequent, thin, micaceous bands in which, in addition to the mica, there is increased pyroxene and feldspar, and much diminished quartz, and which would seem to represent thin shale bands. Equally frequent are basic bands of hornblende mica gneiss, with black pyroxene and soda-lime feldspars for the other constituents, which have thus the mineralogy of gabbros, but are distinctly interbanded with the sediments. Rather thin bands of limestone occur frequently, generally quite impure, showing more or less pyroxene, titanite and graphite, grading often into border rocks of black, heavy character and composed chiefly of pyroxene. These limestones are interbanded with, and grade into the quartz pyroxene gneisses, producing all sorts of intermediate rocks, so that the series as a whole seems made up of alternate limestones and sandstone bands, with an occasional thin layer of shale. Exposures do not suffice to determine whether thick limestone masses are, or are not present. Ophicalcite was found in one single locality in the Moose creek belt. This general group of rocks is the one represented at the majority of the Grenville exposures of the quadrangle. Next to it in importance is the heavy quartzite group. No sillimanite gneiss was encountered, which is surprising, but not infrequently considerable masses of gneiss, both acid and basic, all cut up by quartz veins, and with frequent bands of solid quartz are met, which look sedimentary but are somewhat doubtful

since in composition they are close to some igneous rocks. But their banded character, and the occasional appearance of thin bands which are quite certainly sedimentary, strongly suggest a sedimentary character for the whole. Such gneisses occur in force in the Moose creek belt, along Bog river. The garnetiferous gneisses, both acid and basic, which usually play such a large rôle in the Grenville make little show in the district, though occurring in small amount here and there.

The Grenville rocks are all cut up by other rocks which seem igneous. Some of these are plainly to be classified with the later great intrusions; but others are quite unlike these. Of these last some resemble phases of the gneisses here classed as doubtful, and shortly to be described, while yet others seem to be peculiar to the Grenville association and not to be found elsewhere. Yet their discrimination is a matter of great difficulty, there are so many phases of the other rocks to be borne in mind. Further their supposed diagnostic characters are much easier to recognize than to describe. Some rocks which seem quite certainly igneous are often apparently interbanded with the sediments, and may represent heavily metamorphosed contemporaneous sheets, or flows, or even beds of volcanic ash. Other rocks which are unquestionably igneous, cut the sediments, and yet have not so far been certainly recognized away from the Grenville association. While indisputably later than the rocks which they cut, they are thought to be not greatly younger, and to be much older than the big intrusions. Yet the whole question is an exceedingly difficult one, and the poor and sparse rock exposures of the Grenville throw little light upon it. Some of these rocks have the composition, or at least the mineralogy, of granites, some of syenites, and some of gabbros. The latter are perhaps more apt to be distinctly interbedded with the sediments than are the others, though all seem to have that occurrence at times.

There seems considerable uniformity of structure in the different Grenville belts. The general strike varies from west to northwest, and the usual dips are to the south and frequently high. In the Rock pond belt the strike varies between n. 30° w. and n. 60° w. in the Grampus lake vicinity, and from n. 60° w. to west nearer Long lake, hence has general parallelism with the trend of the belt. In the Moose creek belt the exposures are very poor and the dips are flat, so that it is difficult to get observations of any pretense to accuracy upon

the strike. South from Follensby pond the rocks are much folded and with a general northwest strike, and south dip, but with much variation in both. This is in sharp contrast with the prevailing and usually high south dips in the Rock pond belt. The high dips occasionally run up to verticality and become steep north, suggesting the truncated tops of closed folds, but the north dip never persists very far. The Follensby Grenville is plainly cut out along the strike by the syenites which lie to the west, as would be expected from their proved intrusive character and later date.

Along Cold river the strike varies from n. 25° w. to n. 50° w. in the few exposures, with a general dip of 45° s., though with much variation and plainly much folding. This strike is very suggestive of the extension of this belt to the northwest to a connection with the Moose creek belt, the proof of which can not be furnished owing to lack of exposures.

About Lake Catlin the strike varies from n. 80° w. to n. 60° w. and the dip is again to the south, and usually under 25°. West of the lake the sediments are much involved with gneisses apparently igneous, which soon cut them out entirely. On the hill in the extreme southeast corner of the quadrangle there is a thickness of close to 500 feet of the quartz gneiss exposed.

No order of rock succession involving the different members of the Grenville could be made out anywhere, and but the vaguest ideas concerning the thickness could be obtained. In addition to the quartz gneiss thickness just quoted, a thickness of at least 200 feet of quartz pyroxene gneiss and impure limestone is shown on the low hill just south of Rock pond. But these are mere local details of what is certainly a great and thick rock series.

Doubtful gneisses. These rocks divide themselves into two main groups: in the one we find comparatively uniform igneous gneisses without sedimentary admixture; in the other frequent bands or patches of Grenville rocks, and also frequent rocks of doubtful nature but with a Grenville look, appear, associated with the igneous gneisses. The first group will be styled for convenience the "Long lake gneiss" and the second "the Grampus gneiss." The edge of another great mass of these rocks appears in the extreme northwest part of the quadrangle, and extends widely westward. This will be called the "Piercefield gneiss."

Long lake gneiss. This occupies a large area in the southern half of the quadrangle on both sides of Long lake, constituting the

usual rock which borders the Grenville belts. The exposures exhibit a fairly uniform mass of gneiss, uniform in that it has a certain facies which is readily recognizable. It is not uniform in composition, since it varies from a red, granitic gneiss to a black, gabbroic one, both kinds occurring in many exposures. But the bulk of the gneiss consists of these two sharply contrasted rock varieties. Frequent intermediate varieties occur, and the granitic gneiss shows considerable minor variation; but the group as a whole consists of alternating masses of granitic and gabbroic gneiss.

The granitic gneisses show a twofold facies; most commonly they are finely and evenly granular and quite gneissoid; but mingled with these are many masses of quite coarse, granitic make-up, vastly less gneissoid than the other. In a few cases very quartzose granites of the Morris type, shortly to be described, occur, and they distinctly cut the other and are therefore younger. But in the majority of instances no such relationship is observable, and the distinct impression is created that the one rock is merely a phase of the other; or in other words that the coarse material differs from the fine merely in having locally escaped the excessive granulation which that has experienced.

A red to brown feldspar is always much the most prominent constituent of this rock, comprising from 60 per cent to 80 per cent of the whole.[1] Quartz forms on the average from 15 per cent to 20 per cent, but runs both higher and lower. Black mica (biotite) is the next mineral in importance, though usually accompanied and frequently wholly replaced by hornblende. Both the granites and the granitic gneiss have essentially the same composition, though the latter are usually richer in the black, ferro-magnesian minerals.

Black, amphibolitic gneisses constitute from 20 per cent to 30 per cent of the general mass of the Long lake gneiss. Sometimes they occur in bands only a few feet in thickness with red gneisses above and below, and here they usually appear interbanded, or in other words the contacts are parallel with the general foliation of the mass. From these smaller bands there are all gradations up to very thick masses of large areal extent. For the most part these are hornblende feldspar gneisses, or amphibolites, the feldspar being mainly plagioclase, ranging from andesin to basic labra-

1 The mineralogy of this and the succeeding rocks will be described in detail in a later portion of this report.

dorite. They range from fine grained, heavy, resistant rocks, to coarse, well foliated masses with conspicuous platy hornblende, which are weakly resistant and easily decayed. In the former type there is apt to be considerable pyroxene in addition to the hornblende. In the latter black mica is pretty sure to develop, sometimes in considerable quantity, assisting the platy hornblende in the development of well marked foliation.

In many cases rocks, distinctly intermediate in character between these amphibolites and the granitic gneisses, have been observed. In no case have they been seen to acquire large bulk, and in no case has it been possible to definitely determine their relationships. But since the amphibolites seem at times to shade into the granites through intermediate rocks of the sort, it is quite likely that we are dealing with impregnation of one rock by the other, with the effect disguised and equalized by the subsequent metamorphism.

In all cases where these amphibolites occur in considerable masses, comparatively unmetamorphosed cores are found which show typical gabbro (hyperite) as the original rock. All such found have been mapped as gabbro, both the unchanged core and the surrounding amphibolite being included. In the case of the smaller masses such definite evidence of origin is lacking, and all such have been included in the general mass of the gneiss. Yet they seem quite certainly to represent the same rock, in the one case only partly, in the other wholly converted into amphibolite by metamorphism. A very accessible mass of such amphibolite is that composing the island toward the lower end of Long lake on which the Island House stands. It does not run into gabbro anywhere within the limits of the island, though it may do so under the waters of the lake near by. On all near-by points on the lake shore the granitic gneisses appear.

For the most part then the Long lake gneiss consists of two sharply contrasted varieties of gneiss, both of which are unquestionably of igneous origin. There then arises the question as to their age relations to each other, and to the other igneous rocks of the quadrangle.

It may be stated in the first place that small masses of similar rocks are found involved with the Grenville sediments, and apparently cutting them intrusively. So far as it goes this implies their later age, but in the uncertainty prevailing as to the equiva-

lence of these small masses with the main one it is unsafe to say that the latter is younger than the Grenville, though it is quite likely. On the other hand if there are any rocks in the district older than the Grenville they are here.

The gabbro of the unmetamorphosed cores is exceedingly like the gabbro found elsewhere cutting the anorthosite and syenite, and regarded as the latest member of the general eruptive series. This latter is often somewhat metamorphosed, but its metamorphosed phases show about the same mineralogy as the unaffected rock, though recrystallized into a granular rock, and do not run out into amphibolites, so far as the writer's observation goes. The metamorphism of the one seems less profound and of a different type from that of the other. The writer has never found these amphibolitic gabbros in connection with the great intrusives, never except in association with the granitic gneisses, the Grenville rocks possibly excepted. The difference may perhaps be accounted for on the supposition that the inclosing granitic gneisses were less effective as a protecting buttress against the stresses producing metamorphism, than were the massive and bulky anorthosites and syenites. And while this may be true and the two gabbros, notwithstanding their differences, be of the same age, it seems a much less likely supposition than that the one gabbro is much older than the other and its more profound metamorphism thus to be accounted for.

Within the limits of the quadrangle no satisfactory evidence respecting the relative ages of the two main constituents of the Long lake gneiss, the granite and the gabbro, has been discovered. Elsewhere in the Adirondacks however the writer has found amphibolites, in all respects like those produced from the gabbro by metamorphism, distinctly cut by granites very similar to, if not identical with, these granitic gneisses, indicating that the gabbro is older than the granite. Since there is some question as to the precise identity of each of the rocks concerned, it is not safe to theorize too widely. It does however indicate the presence of a gabbro in the region older than a granite, both of which have suffered intense metamorphism; and hence enforces caution respecting the tendency to class all gabbros together because they are gabbros, and all granites because they are granites. While in doubt regarding these Long lake gabbros the writer is disposed to regard them as older than the anorthosite, hence distinct from the later gabbro.

There is the further question, involved with the last, whether the granitic gneiss is a member of the general eruptive series, or is a considerably older eruptive. In part it is to be classed as a granite rather than a granitic gneiss, and this granitic portion may be younger than the rest or may represent less metamorphosed cores of the gneiss, analogous to the gabbro cores of the amphibolite. There is certainly some younger granite in the mass, but the impression given is that most of it is not separable from the gneiss and is simply a less metamorphosed phase of it.

Ogilvie has recently described from the Paradox Lake quadrangle, a gneiss which has many features in common with this granitic Long lake gneiss, if indeed it be not identical with it, and regards it as a granite belonging to the general intrusive group and younger than the anorthosite and syenite.[1] That there is a considerable body of granite in the region of which this is true, the writer is firmly convinced. But he is equally convinced that there is much granitic gneiss in the region which is much older than the anorthosite, and his present disposition is to refer the Long lake gneiss in the main to that group. It would vastly simplify geologic work in the region if Ogilvie's interpretation of the Paradox granite could be shown to be generally applicable to the granitic gneisses of the district; but there are difficulties in the way. The anorthosites and syenites contain not infrequently gneiss inclusions, sometimes of amphibolite, and sometimes granite. These are unquestionably older than the intrusives. Now there are amphibolites and granites associated with the Grenville rocks and the uncertain matter is whether these inclusions are from such rocks, or not. If not they distinctly point to the presence of older bodies of such rocks other than those associated with the Grenville; or else to large bodies of such rocks of which minor offshoots cut the Grenville rocks. The writer has not yet obtained any evidence in the region which satisfactorily clears up these points. So the mapping of these rocks as gneiss is merely a makeshift, indicative of lack of exact knowledge respecting their age.

Grampus gneiss. In the southwestern part of the quadrangle is a mass of gneiss which differs materially from the Long lake gneiss in the considerable diversity shown. It is in association with the Grampus Grenville and shows frequent patches of Grenville sediments of various kinds, which are too small to map on

1 N. Y. State Mus. Bul. 96, p. 484 et seq.

this scale. There are various other gneisses present which are unlike anything found in the Long lake gneiss, except in the near vicinity of Grenville belts, most of which seem igneous, though some are of doubtful origin. Some of these gneisses are easily recognizable, others are discriminated from the Long lake gneiss only with difficulty. Along with all these is a general matrix of Long lake gneiss.

There is, for example, much of a black and white gneiss, which consists of hornblende or pyroxene and plagioclase feldspar, either andesin or labradorite, with accessory apatite, magnetite, titanite and zircon. In most of the occurrences the feldspar predominates, and the rock is spotted in appearance and fine grained. With increasing hornblende the grain becomes coarser and the rock is striped instead of spotted. Often one variety is interbanded with the other. A similarly appearing rock in the field shows pyroxene instead of hornblende, with much titanite and a more acid feldspar (oligoclase). These rocks have the mineralogy of gabbros and diorites, but the field appearance is often suggestive of a sedimentary origin. There is often a strong resemblance to the rock of the "Whiteface" region which Kemp has described as the "Whiteface type" of anorthosite.[1] That rock behaves at times like an intrusive, at others strongly suggests a sediment, and its true nature and relations have not been clearly made out. If an igneous rock, its customary Grenville association has not been explained, and a close association in age is indicated; an age older than that of the ordinary anorthosite.

Another gneiss in this group is a red, usually acid, rock composed of quartz and alkali feldspar, with a considerable content of green pyroxene and a deep colored titanite. This rock is also quite variable and is a frequent rock in the Adirondack region, often associated with magnetite deposits, as at Lyon Mountain. Its true nature, association and age are yet to be discovered.

There is also found much of a peculiar granitic rock, differing in appearance from the ordinary Long lake granitic gneiss, the difference being difficult to describe, though easy to recognize. It is a rock of medium grain, not extra gneissoid, much lighter red than the Long lake gneiss, and contains from 10 per cent to 20 per cent of hornblende, magnetite and biotite. It occurs in a great number of Grenville sections, lying in among the sediments, or cutting them

1 N. Y. State Geol. 15th An. Rep't. 1895. p. 587.

out, both above and below. It also occurs away from them in the general body of the gneiss. It may be a phase of the Long lake gneiss modified in appearance by the incorporation of Grenville material, but this seems unlikely, in view of its composition and it is tentatively regarded as a Grenville igneous rock, one whose injection took place during, or only shortly after, the deposition of that series. It is also thought that there are gabbros of similar age in the region, though no such have been identified within the quadrangle limits.

There are various other varieties of gneiss found in the Grampus vicinity, though of very minor importance compared to those already enumerated. The whole mass is well banded, with frequent variations in composition and gives the impression of a Grenville area so intruded with igneous rocks of all kinds and ages that the Grenville has well nigh disappeared, the whole subsequently excessively metamorphosed. In consideration of its complicated nature, and the trifling amount of certain sediments included, it is thought wiser to give it a noncommittal mapping than to map it separately from the Long lake gneiss.

Piercefield gneiss. In the extreme northwest corner of the quadrangle there appears the eastern apex of a great mass of gneiss which lies mostly beyond the quadrangle limits, and which affords a somewhat different rock admixture from either of the foregoing. The rocks are excellently exposed about Piercefield, and in the railway cuts between Piercefield and Tupper Lake. These latter are on the edge of the main syenite mass, and show excellently two of the varieties of gneiss concerned, and their relations. These are a green, syenite gneiss and a red, granitic gneiss. The former is exceedingly like some of the very gneissoid phases of the syenite, near at hand. In one cut the red gneiss plainly shows an intrusive contact against the green; in another a pegmatite is at the contact, which repeatedly injects the green gneiss along the foliation planes. The pegmatite is a granite pegmatite, and seems to be a phase of the red gneiss. In both cases the green gneiss, which is quite hornblendic everywhere, becomes excessively hornblendic near the contact, and this is regarded as a contact phase of the green gneiss, though it is an unusual contact rock. Here is a syenite cut by a later granite, and a large mass of syenite near at hand. It would seem most probable that the two belong together, but they do not look alike, there are some differences in their mineralogy, and some

slight differences in their chemical composition also. Much of the red gneiss is of the type which contains green pyroxene and deep colored titanite, like that described from the Grampus lake area, and some of the green gneiss has the same minerals in abundance. There are also other gneisses present in minor quantity. It is quite likely that the green gneiss actually belongs with the main syenite mass, its differences being due to the granite intrusion. If so then in all probability most of the Long lake and Grampus gneiss should be classed with this granite as a great bulk of granite intrusive, later than the syenite, as Ogilvie has argued for the Paradox lake area. Owing however to the differences between the two rocks the writer hesitates to adopt this view without more decisive evidence, and has again taken refuge in noncommittal mapping.

Great intrusions

Anorthosite. A great mass of this rock lies in the northeast portion of the quadrangle and comprises about one fourth of its area. It is but a small segment of a great batholite of the rock which has a wide extent in Essex and Franklin counties, and forms the larger part of the surface of the three quadrangles, Santanoni, Saranac and St Regis, which bound the Long Lake quadrangle on the north and east. It represents the earliest of the great intrusive masses which invaded the region in Postgrenville times. It is one of the most easily recognizable rocks of the Adirondacks, and its area is accurately mapped, so far as surface exposures will permit.

This great mass of molten rock ascended to its present position and solidified, not at the surface but underneath a great thickness of overlying rock. This cover, and the upper part of the anorthosite itself, have since been removed by slow surface erosion. The present surface extent of the rock is simply the area of the original mass at the horizon where the present erosion surface cuts it. We can only conjecture as to its extension downward, though it no doubt runs deep and broadens downward. The amount worn away from the surface is less conjectural. Sections of the rock of above 3000 feet in thickness are exhibited in some of the mountains which it composes, suggesting the removal of at least that amount from the neighboring valleys, with an additional unknown amount from the summits. This however necessitates the assumption that the original upper surface of the mass

Anorthosite ledges by Indian carry, near Rustic lodge

was comparatively even, which is far from likely. Near the present borders of the mass inclusions of the older rocks are found, suggesting that here we are near the actual upper limit. Since the rock was formed the mass has been much dislocated by faulting, shifting the relative levels of the old surface in the various fault blocks. This also urges caution in assuming that 3000 feet or more have been generally worn away from the valley regions, and also renders it certain that quite different amounts have disappeared from the surfaces of the various fault blocks. If however the present surface were not far beneath the original surface it would seem that inclusions of older rocks should be more common than they are in most of the anorthosite district, and that we should also find downfaulted blocks of other rocks within it. So far as the writer is aware, such phenomena are mainly confined to the borders, and thus a quite respectable amount of wear from the upper surface is argued.

The rock solidified as an exceedingly coarse porphyry, large crystals of labradorite feldspar, often several inches in length, abounding, surrounded by smaller crystals of the same material, for as a whole the rock is made up of this mineral, other constituents being present only in very minor degree. The large crystals are of deep, blue-black color, often iridescent, and show bright, glistening cleavage faces, on which twinning striations are usually plainly observable. Originally the remainder of the rock was of the same color and in the least metamorphosed portions, when unweathered, it is today.

Changes of composition are observable, both locally within the mass, and quite uniformly as its border is neared. These consist in increase in amount of the other rock constituents, with corresponding diminution of the feldspar. This may continue until they equal the feldspar in amount, and in exceptional cases exceed it, but these are extreme phases and one rock slowly grades into the other. These other minerals are augite and titaniferous magnetite, which are present everywhere in the rock in small quantity, and hornblende, hypersthene and garnet, which are not everywhere present, but are universal in the less feldspathic portions. Chalcopyrite is a widespread constituent, though in small quantity. The garnet commonly forms zonally around the magnetite, separating it from the feldspar, and the black center with the red zone of garnet surrounding it is a very common

feature of the rock containing these constituents. Most of the anorthosite of the quadrangle contains garnet and the black minerals in noticeable quantity, owing to its comparative nearness to the border.

Like the other Precambric rocks the anorthosite has been much metamorphosed, being crushed or granulated and somewhat recrystallized. But owing to its original very coarse texture, and to the fact that granulation mostly commences at the edges of crystals and slowly works its way inward, the rock does not appear so thoroughly metamorphosed as do the other rocks, none of which approached it in original coarseness of grain. The crushing which would have completely granulated a more finely crystalline rock would only partially destroy the large labradorite crystals, and uncrushed cores of large or medium size would remain, even in the most excessively metamorphosed portions of the rock. With increase in the amount of dark minerals present the original grain of the rock seems to have been progressively less coarse and such rock is generally more completely granulated, with the uncrushed feldspar cores fewer in number and of smaller dimensions. This is a more common rock within the quadrangle than the coarser and purer variety.

In some portions of the rock the feldspar crystals are more numerous, are smaller and are all arranged with their long axes parallel. This is a "flow structure" due to movement in the mass during solidification, which has strung out the already formed crystals into parallel arrangement.

The granulated portion of the rock varies in appearance according to the fineness of the crushing. In the majority of instances where not too finely granular, it has a grayish green to grayish blue tinge weathering to brownish. In more severely mashed portions the grain is very fine, gray to white is the color, the rock is very dense and hard, and uncrushed crystals much less frequent and of smaller size. Sometimes locally, either near bodies of later intrusives, or else in badly sheared portions of the rock, the feldspar has been largely altered to a dull, white or greenish white material known as saussurite. This is quite different material from the soft products of surface decay of the same mineral. Rock of this sort makes up the rock point on the east bank of the Raquette river ½ mile below the Raquette Falls landing. Similar material occurs at various places in the woods.

Gabbro border of the anorthosite. The gradual change in composition outlined above continues until, as an extreme product, a rock is obtained in which the heavy, dark colored minerals equal or exceed the feldspar in amount. A steady diminution in coarseness of texture accompanies this change, the uncrushed feldspar cores become continually smaller and less numerous till they finally disappear, and foliation becomes more and more prominent, so that the final product of the change is a heavy, dark colored gneiss which bears no resemblance whatever to the normal anorthosite, and would not be recognized as a variant of that rock by an observer who met it for the first time, coming upon it from without the anorthosite area. If approached from the other side however the steady change from one rock into the other is plainly manifest. This final rock is not anorthosite but gabbro, and the rock intermediate between the two may be called anorthosite gabbro. It is perfectly evident from the field relations that this border phase of the anorthosite was produced by some process of differentiation in the general mass of igneous material after it had reached its present resting place, prior to or during solidification.

For the larger part of its extent across the quadrangle the syenite, to be next described, adjoins the anorthosite, and a moment's inspection of the geologic map makes it evident that it has encroached upon, and cut out the anorthosite border to some extent. Between Follensby pond and the Raquette is a considerable mass of syenite which cuts out nearly the whole of the gabbroic border locally, and holds great inclusions of it likewise. In the Tupper Lake vicinity also the anorthosite has been badly cut out by syenite, and here again much of the gabbro border has disappeared. Outside the limits of the quadrangle there are localities where the gabbro border is lacking where its nonappearance is clearly owing to faulting. It is quite likely that originally the entire anorthosite area was characterized by such a differentiation border.

In addition to this border differentiation to gabbro, a similar change has also taken place here and there within the general anorthosite mass. A prominent area of the sort occurs near Panther pond, within a mile of Upper Saranac lake, which has been mapped as gabbro. As it is approached the anorthosite becomes rapidly more gabbroic, but at the same time dikes of gabbro appear, cutting the anorthosite and in regard to the gabbro center it is not certain

whether it should be classed with the anorthosite or with the gabbro dikes. But these latter do not seem to be greatly younger than the general mass, and quite likely represent the injection of a portion of the mass which had already solidified by material from a yet liquid portion.

Within the Santanoni quadrangle, next east, local differentiation has produced the masses of titaniferous iron ore of the Lake Sanford and Lake Henderson region.[1] These are well within the anorthosite mass with quite pure anorthosite for the general wall rock, and are remarkable for the narrowness of the gradation zone. No such masses, large or small, have been noted within the Long Lake quadrangle.

This border gabbro is a rather uniform grained rock, of sufficient coarseness so that the white of the feldspar, the red of the garnet, and the black of the pyroxene, hornblende and magnetite are all prominent. In the less extreme phases of the rock, occasional small uncrushed feldspar cores remain. But the small, glittering, lath-shaped feldspars which are prominent in the less metamorphosed portions of the gabbros associated with the Long lake gneiss have not been noted in this border rock, and the distinction is believed to be characteristic of the two rocks.

Anorthosite outliers. Three small outlying masses of anorthosite have been noted within the limits of the quadrangle, and doubtless there are others which have been missed, or which are covered by glacial deposits. Only masses rather remote from the main body are here under consideration. Curiously all three are in Litchfield park. They are from 4 to 7 miles distant from the main mass, with an intervening broad belt of Grenville rocks. To account for their presence here, and their nonappearance elsewhere is a difficult problem. In but one case do the exposures suffice to give any clue to their relationships to the surrounding rocks.

The more northerly of the three outliers forms the summit of a small hill which lies between Jenkins and Long ponds. The hill breaks down quite steeply on the north and west in bare rock cliffs, was burned over some years ago, and second growth has not yet gained a foothold on the bare rock, so that exposures are excellent. The hill also forms an easily accessible and excellent viewpoint in all directions but eastward.

In going north to the hill from the road between Jenkins and

1 Kemp, J. F U. S. Geol. Sur. 19th An. Rep't, pt 3, p. 409–17.

Long ponds, the rock at first is the granitic phase of the syenite, cut by dikes of fine grained red granite. This is shortly replaced by a variable rock which seems clearly a basic phase of the ordinary syenite, also cut by the red granite. At the extreme top is the anorthosite, extending about 300 yards in a northeast-southwest direction. The rock is quite typical, is medium grained, and labradorite feldspar constitutes 95% of it, magnetite, augite, chalcopyrite and apatite being the other minerals. Not only is the passage from the syenite to the anorthosite abrupt, but in addition the latter is all cut up by dikes of the former, both large and small. It is also cut by dikes of the same red granite as that found cutting the previous rocks.

On its northwest side the anorthosite is cut out by a reddish syenite whose relations to the main syenite are not absolutely certain, though if it be not identical it is a closely related rock. Red granite again occurs cutting both the other rocks. The anorthosite is badly cut up by them and has been much altered in appearance, likely by the heat and gases given off by the invading molten rock. The feldspar has been mostly converted to saussurite, producing a dull, white rock.

This exposure, though small, is of much interest in that it clearly shows anorthosite cut by syenite, which is therefore younger, and granite cutting both the others and therefore youngest of all, the anorthosite being entirely surrounded by the other rocks, and therefore an inclosure in them. A plausible explanation of its position, so remote from the main mass, and its inclosed situation in the later eruptives may be made by the following assumptions: that the anorthosite batholite originally extended to the locality, or else sent a large offshoot to it; that the later syenite invaded it and cut it out from beneath, sending out at the same time the big tongue of syenite which cuts out the anorthosite clear to the Raquette river; that the anorthosite inclusions indicate that the present surface is not far beneath the original upper surface of the syenite; that Grenville rocks originally overlay the whole, and have since been removed by erosion; and that later trough faulting dropped the block of Grenville that lies between, so that it has been less worn away, the syenite and anorthosite beneath still retaining a Grenville cover. though it has disappeared elsewhere.

The second anorthosite outlier is near the county line (Franklin-Hamilton) 1½ miles from the west edge of the quadrangle. On the

south syenite gneiss adjoins it, and on the north granitic gneiss and amphibolite, similar to the Long lake gneiss. Unfortunately no contacts are exposed so that the interrelationships of the rocks are most uncertain. Since the previous outlier proved to be an inclosure in later rocks it would be natural to regard this as probably a similar occurrence. The rock however differs from the last, is much mashed, the feldspar shows wide variation in composition, especially considering the small size of the mass, and much scapolite has developed. It is not impossible that it may be a small outlying intrusion, connecting beneath with the main mass, and with the syenite cutting it out on the south. The rapid changes in character from place to place which it shows are more readily explicable on that supposition than if it is regarded as a small fragment detached from the main mass. But the whole question hangs upon the age of the granitic gneiss, and it is therefore doubly unfortunate that no contact appears. If the gneiss is older, this is a small separate intrusion, or branch from the main intrusion; if the gneiss is younger it is certainly an inclosure.

The third outlier is upon the county line, 2 miles east of the second. It is completely surrounded by gneisses of uncertain nature and age, and no contacts are exposed. The rock is very gneissoid, no feldspar cores whatever remaining in much of it. It also holds from 10 per cent to 20 per cent of minerals other than feldspar. The feldspar is an acid andesin instead of labradorite, being in this respect like some of the feldspar of the previous outlier. Both rocks are quite different from the ordinary anorthosite, while the rock from the first outlier is quite normal. This is but natural if the two latter represent small intrusions into earlier rocks.

Syenite. The general syenite of the Adirondacks has a much more irregular and patchy distribution than has the anorthosite, and the present day surface exposures belong to a series of separate masses both large and small. One of the greater of these masses, the Tupper syenite, has the larger part of its present surface within the quadrangle limits and, with the exception of a few outlying intrusions which are likely offshoots from it, is the only syenite mass within the quadrangle. It is separated into a smaller eastern, and a larger western portion by the Follensby Grenville. But if that lies in a downfaulted trough, as seems highly probable, the syenite may be legitimately regarded as continuous underneath, so that the separation into two masses is only apparent, and due to faulting.

Glaciated ledges of augite syenite forming a small rock island in Tupper lake, and similar knobs on the shore

The rock is exceedingly variable, much more so than is the anorthosite. All the varieties grade into one another, so that any separation in mapping is an arbitrary matter, necessitating the drawing of boundary lines where none exist. Yet the extreme variations are so unlike the normal rock as to require separate rock names, and must be given a place upon the map, even at the cost of arbitrary boundaries.

Normal syenite. This is a green to grayish green rock when fresh, with a rapid color change on exposure to the weather, assuming a yellow-brown tinge and then becoming a rusty brown, the normal color on exposed surfaces. Over most of the district the weathered crust is not thick, and in any opening in the rock the normal green is quickly reached. It is a highly feldspathic rock, only second to the anorthosite in this respect, but carries from 10 per cent to 20 per cent of other minerals, quartz, pyroxenes, hornblende and magnetite. Quartz never wholly fails, though not rising to large proportions in the normal rock. The pyroxenes are peculiar, and characteristic. The feldspar (microperthite) is of an entirely different nature from that of the anorthosite, is never iridescent, and does not show twinning striations on cleavage faces.

The original rock was not so universally porphyritic as was the anorthosite, was seldom coarsely so, and even where coarsest was not comparable to the anorthosite in that respect. Hence, though the two rocks have experienced substantially equivalent metamorphism, the syenite has mostly been mashed by the process, uncrushed feldspar cores being very few and very small in comparison with the anorthosite. They are generally present in the normal rock however. For this reason the syenite has a more gneissoid look, and an appearance of greater metamorphism which is deceptive.

The variations of the rock are in two main directions. In the one case the dark colored minerals increase in quantity at the expense of the feldspar, garnet appears, and quartz diminishes and disappears. The syenite passes into a monzonite and ultimately into a shonkinite. The rock also becomes more even grained and gneissoid, as does the anorthosite in its similar variation. The more basic varieties have the dark minerals equaling or exceeding the feldspar in quantity and so strongly imitate the gabbro gneisses of the anorthosite border that they are exceedingly difficult to distinguish. In fact distinctly intermediate

varieties appear, strongly suggesting that one rock has been modified by incorporating material from the other.

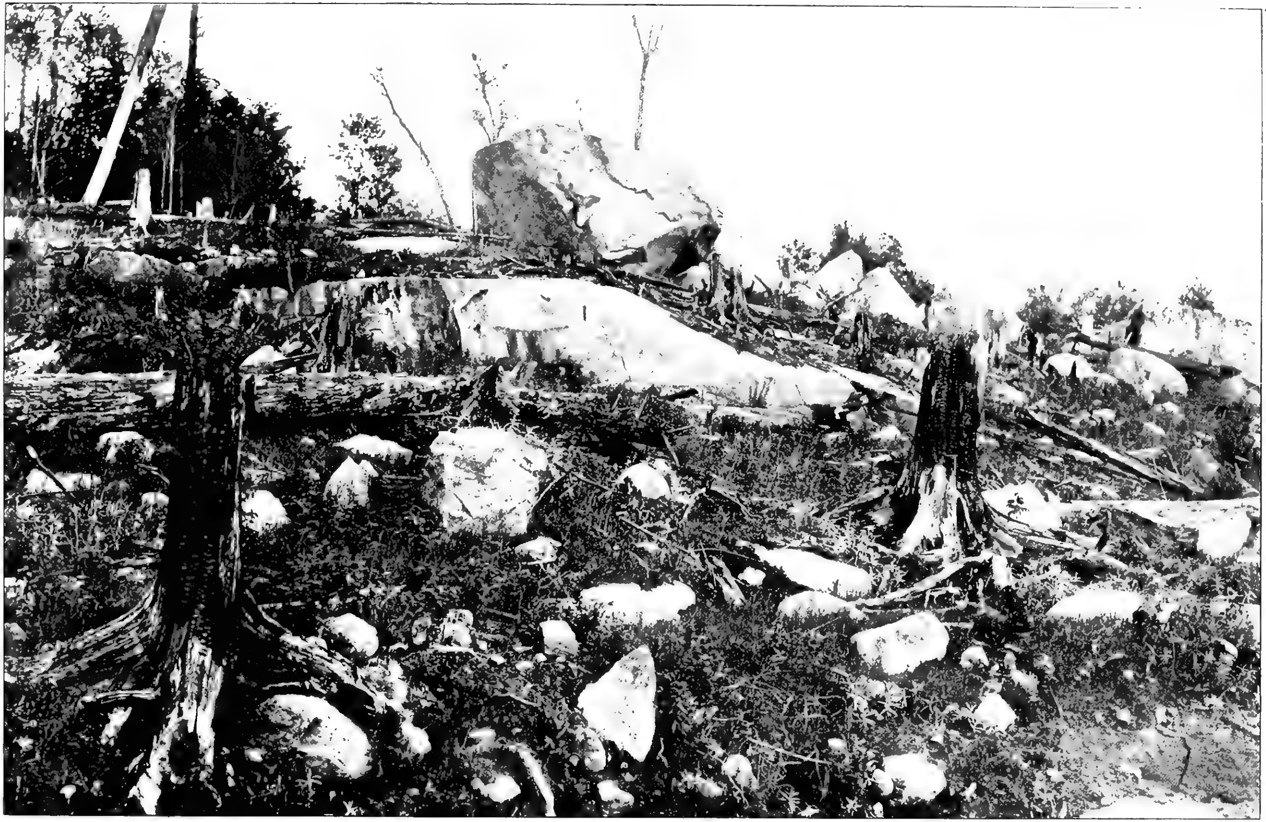
In the other direction the rock changes by increasing quartz. The quartz also tends to appear in coarse leaves, or spindles, which are very prominent on the weathered surface or in the hand specimen. The feldspar also changes slightly and tends to become red instead of green producing green and red mottled rocks. Finally the red predominates and the rock becomes a distinct granite.

Basic syenite. This is in general a rather finely granular rock of general black color but sufficiently coarse so that the component minerals plainly show their proper colors to the eye. The feldspar is usually brown, though it is green where fresh material can be obtained. Garnet is in general not so prominent as in the gabbro, and the rock tends to a finer and more even grain, but the differences are slight. In general these basic rocks are confined to the near vicinity of the anorthosite, though in the ordinary syenite there is much variation from place to place in the percentage of dark colored minerals. It will be later shown that, even in thin section, it is very difficult to distinguish these rocks from the gabbros owing to the lack of distinctive features in the feldspars, but that chemically they are easily separable.

Granitic syenite. As mapped this comprises a mass of very variable rock, much cut up by later granite, excellently exposed in Litchfield park and in the two big ridges which run north from it. Admirable exposures, often blasted, are found along the park roadways. Much of the rock is alternately green and red, quite quartzose, and a rock distinctly intermediate between syenite and granite, often passing into granite. Much of it is uniformly red, and the red rocks range from syenite to granite in composition. It is not certain that all these latter rocks are of the same age, and differentiate in place of the main mass, and this is especially true of the red syenite. But it is certain that much of the rock has this character, and the whole is manifestly bound together as a mass of eruptive material arising from a common magma. It is all cut up by dikes and larger masses of a red granite, mostly too small to map separately, a rock to be shortly described as the Morris granite.

Asymmetry of the syenite differentiation. The formation of a gabbro border to the anorthosite by some not well understood process of differentiation, has been seen to be a rather uniform

Plate 3



Ledges of red quartz-syenite, strewn with glacial boulders; north shore of Jenkins pond, Litchfield park

feature of that rock. The syenite presents a sharp contrast in this respect, in that its differentiation is prominently asymmetric, and that, in the case of the Tupper syenite at least, this seems conditioned on the nature of the bordering rock. The most of the basic syenite, and all of the more gabbroic of it is in close association with the anorthosite gabbro border; and the same feature is noted around the large anorthosite inclosures in the syenite. It is also true of the syenite bordering the anorthosite outlier in Litchfield park, this being the only basic syenite which occurs anywhere in the vicinity, so that its presence is especially significant. The differentiation into granite takes place on the south side of the mass, the bordering rock on the south being granitic Long lake gneiss. In each case the syenite grades into a rock approaching in character the adjacent rock. Now the syenite is unquestionably younger than the anorthosite, as will be immediately shown, and the observed relations seem to point to the conclusion that the change is due to the actual digestion, by the molten syenite, of material from the adjacent gabbro. The relations on the other side are not so clear, since the age of the bordering granitic gneiss there is unknown. If it be an older rock, as it is tentatively held to be, then the asymmetry of the syenite is certain. But if it should prove to be a younger granite then the view may be legitimately held that this granite has cut away a large part of the original syenite mass, thus accounting for its apparent asymmetry. In consideration of the great amount of syenite that must be regarded as having disappeared on this hypothesis, however, it is vastly less probable than the other. In this connection it should be recalled that the Diana syenite, as described by Smyth, shows a quite similar asymmetric differentiation.[1] The character of the differentiation may thus be regarded as reasonably certain. The explanation to account for it, namely the incorporation of material from the adjoining rocks, is much more open to question.

The syenite younger than the anorthosite. Reconnaissance work in this district in previous years had led the writer to believe the syenite to be younger than the anorthosite and the evidence then obtained was set forth.[2] It was not however demonstrative, and as the matter is one of considerable importance in Adirondack Precambric geology, it was hoped that a detailed survey of the

1 N. Y. State Geol. 17th An. Rep't. 1897. p. 471–86.
2 N. Y. State Geol. 20th An. Rep't. 1900. p. 141–52.

boundary between the two rocks might furnish proof of its verity. This was in fact one of the principal reasons for the selection of this quadrangle for detailed study. The hope was fulfilled, the evidence being as decisive as could be desired.

About Raquette falls, on both sides of the river, anorthosite and syenite are found in mixed distribution. All exposures are in the woods, in no case was any contact observed, and it is only by the relative abundance and distribution of the two rocks as brought out by the mapping that it is inferred that east of the river the syenite is present as small bosses or large dikes, cutting the anorthosite, while west of it the anorthosite has been largely cut out and mostly occurs as inclosures in the syenite.

The evidence given by the first anorthosite outlier in Litchfield park has been already presented. The anorthosite is definitely cut by syenite which sends dikes into it. The syenite is of the basic variety in part, and in part is reddish syenite; the whole is surrounded by a zone of mixed rocks, granitic syenite and granite which, though believed to be mostly a differentiation phase of the syenite, lies between it and the normal syenite farther north, preventing the definite tracing of one rock into the other.

It is along the northern edge of the quadrangle, where the land has been cruelly lumbered of late years, where the great fire of May 1904 made a clean sweep of what was left, and where much of the land has since been cleared, that the decisive evidence was obtained. Even as far east as Upper Saranac lake occasional dikes are found cutting the anorthosite. These are narrow, the dike rock is fine grained and peculiar and of two main types. One is a hard, ringing, light colored, feldspathic rock, with frequent small garnets, but with other dark minerals present but sparingly. The other is a dark, heavy, gabbroic-looking rock, with abundant garnet. From its appearance in the field it might be either a gabbro or a basic syenite. Now while these rocks suggest syenite in appearance they differ much from the main body of the rock, which shows no similar phases. Yet it is obvious that the physical conditions under which they cooled differ so much from those under which the larger masses solidified, that a considerable difference in appearance and character is normal, rather than abnormal. And the study of thin sections led to the confident belief that they were really dike offshoots from the main mass prior to the discovery of decisive field evidence.

The series of exposures that decisively settle the question occur along the Wawbeek road within the first 4 miles eastward from Tupper Lake. In the neighborhood of the village itself the rock is quite typical augite syenite, though with a tendency to become basic locally, well shown in the road metal quarry near Raquette pond, where the rock is very hornblendic and lacks feldspar augen [pl. 18]. The syenite runs eastward for about a mile, then for an equal distance there are no outcrops, after which they are numerous on both sides of the road, the best and most continuous being south of it, where exposures run with practical continuity for another mile. The rock is chiefly anorthosite, somewhat gabbroic, but by no means the normal border gabbro,

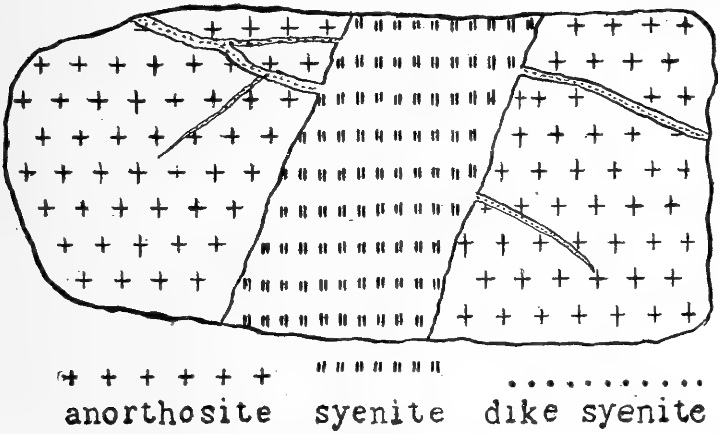


Fig. 1 Relationship of syenite and anorthosite, as shown in an exposure 2 miles northeast of Tupper Lake village, and not far south of the Wawbeek road. Scale 1 inch = 3½ feet

this of itself suggesting that part of the mass has been cut away by the syenite. In addition it is everywhere cut through and through by dikes of the syenite, both large and small, and in increasing number as the main syenite mass is neared. The wider dikes show a rock identical in all respects with the syenite about Tupper Lake, sometimes basic, at others not so, and there can be no question that they represent direct offshoots from the main intrusion, cutting into the anorthosite. From these larger dikes, composed of normal syenite, slender branches may be seen running out into the anorthosite, and in these the rock is at once recognized as identical with that found in the more remote slender dikes, giving a demonstration of their origin, and of the fact that they differ from the ordinary rock because of their slenderness, and hence more rapid cooling. In figure 1 is given a

sketch of a portion of one of these surface exposures, which shows the observed relations clearly. Just adjoining it on the east is an exposure which shows chiefly syenite, but with inclosed blocks of anorthosite. In these exposures neither of the two rocks has the extreme basic character of the usual border phase of each, though the syenite is more basic than the normal rock.

Granite. Both the anorthosite and the syenite, especially the latter, are found cut by dikes and larger masses of granite. So far as the writer's experience goes this granite is always of a single, easily recognized type which he has called the "Morris granite," from its frequent occurrence on Mount Morris, south of Tupper lake. This is a quite uniform, red, very acid granite, constituted almost wholly of red feldspar and quartz, other minerals being usually not visible to the eye. It presents both a fine grained and a coarse phase, the former being more common. The coarse type is especially distinctive because of the segregation of most of the quartz into coarse leaves or spindles, which are very prominent in both the weathered and unweathered rock, and stripe the red feldspar with streaks of dark, glassy quartz. In the other and more common type the quartz shows as small, dark colored, glassy spots in the prevailing red of the yet finer grained feldspar. In some exposures the fine type appears as a border phase of the coarse and the coarse type has not been seen without the presence of the other also. The fine type however frequently occurs without the other being present, the narrower dikes of the rock are always composed of it, and some of the larger ones also. The coarse is not only found grading into the fine, but also appears cut by it.

The granite produced as an extreme phase of the syenite differentiation differs much from the Morris granite in appearance. It is usually coarse grained, though running locally into fine types, is quite hornblendic, and is not especially quartzose. The black blebs and streaks of hornblende distinguish it sharply from the Morris type. In the coarse varieties the quartz tends to assume the leaf form, but the quartz is usually subordinate to the hornblende in prominence. Varieties however do occur which are distinctly intermediate between the normal types.

These two granites belong unmistakably to the general group of the later intrusives. Similar rocks are found here and there within the general body of granitic gneisses of the region. But

their presence does not aid in the general solution of the problem as to the age of the bulk of this gneiss, since if it be older it would be apt to be cut, here and there, by outlying masses of the later eruptives. Such masses are frequently found in it, but in general the evidence does not permit the determination of their character, whether they cut the gneiss or belong with it.

Gabbro. The gabbros are dark colored, basic rocks, usually showing a reddish tinge owing to the presence of garnet. As found within the quadrangle the rock occurs mainly in the dike form, and these dikes have been noted cutting all the other eruptives, with the exception of the granites, leaving the relative ages of the two somewhat in doubt though the granite is thought to be the older. In addition to the dikes is the small boss which cuts the anorthosite south of Panther pond. The rock for the most part is tough and resistant, and generally rather evenly granular. It lacks the gneissoid character of the gabbro border of the anorthosite, and weathers much less readily than that. It has not been noted grading into amphibolite, after the fashion of the gabbro found with the Long lake gneiss. The smaller masses and the dikes of that rock are always found in the amphibolite condition, and this more metamorphosed condition seems to argue a greater age, though it is possible to explain it as due to local causes. The unchanged cores of that gabbro have also a more pronounced ophitic structure than has been noted in this later gabbro, though that also tends toward the same structure in the larger masses. It is only with the greatest difficulty that the rock can be distinguished from that of the dikes of gabbroic syenite. This will be later reverted to.

As a possible exception to the above statement the gabbro knob at the farm in Litchfield park, just west of Jenkins pond, must be instanced. This is thoroughly metamorphosed to a micaceous amphibolite, yet is an unquestioned gabbro; nevertheless it is entirely surrounded by granitic syenites, regarded as belonging to the later eruptives. Unfortunately no contacts show and the relations between the two rocks can not therefore be made out. It would seem to be easiest accounted for on the assumption of a knob of later gabbro cutting the syenite. It is rather large for an inclosure in the syenite, yet the writer's present disposition is to regard it as such, since the Long Lake gneiss is close at hand to the south. If it be not, it of course vitiates the attempt made above to

discriminate between the two gabbros on the basis of difference in character.

Diabase. But two dikes of this rock have been noted within the quadrangle limits. The larger and more accessible of the two is on Round island, in Long lake, showing the usual dense, heavy, black rock with chilled borders and coarser center, and with occasional porphyritic feldspars. On the southeast edge of the island both contacts with Grenville rusty gneisses are exposed, showing the dike to be 30 feet wide and to bear n. 30° e., and that it is not vertical but dips 60° s. No fresh material could be obtained from the dike but it is one of the ordinary olivine diabases of the region.

The other dike was noted on the south slope of an anorthosite hill on the east edge of the quadrangle. Neither contact showed and there was but a single exposure so that its thickness and trend can not be stated. It is an ordinary nonporphyritic diabase. Two other similar dikes are known just west of the quadrangle limits on the Tupper lake sheet, and a few have been located on the comparatively unexplored and rugged Santanoni quadrangle, just east. They are infrequent in the mid-Adirondack region, though abundant farther east.

ROCK STRUCTURES

Foliation.[1] The rocks of the northern half of the quadrangle are chiefly massive eruptive rocks, in which foliation is absent, or at best only rudely developed. This is mainly owing to their highly feldspathic character, and the scarcity of the minerals which are good producers of foliation. The gabbroic anorthosite and the basic syenite have it much better developed, and the tendency of the quartz to assume the leaf type is responsible for a poor foliation in some of the granites. Conspicuous foliation is only found in the Grenville rocks and portions of the Long lake, and Grampus gneisses.

In the Grenville sediments foliation and bedding correspond, in all cases in which it has been possible to determine their relationship. But the Grenville rocks cover such a comparatively small portion of the area, exposures are so infrequent and in general so poor, and the stratigraphy of the series is so little known, that scant idea of the general structure could be obtained from the usual methods.

1 Foliation is a convenient term for that variety of flow cleavage found in wholly crystalline rocks, which have wholly or largely recrystallized under pressure, and which hence possess a parallel arrangement of mineral particles, resulting in a capacity to split more readily in one direction than in any other.

In the Moose creek belt the dips are so flat that they can seldom be made out with certainty. Elsewhere they are higher, and in a few instances distinct folds are shown. These are of the sharply pinched, or closed type, steep south dips becoming vertical and then steep north. But north dips are exceptional. Such folds as show pitch show it to the west or northwest, but it can seldom be made out.

Since no aid could be obtained from the stratigraphy in deciphering the structure of the region, it was hoped that some light would be thrown on it by a careful plotting on the map of all the observations on the foliation dip and strike [*see* map]. In many of the exposures only the strike can be made out, and this is notably the case in the poorly foliated eruptives. Even in the gneisses the foliation is often poor and indistinct, making exact observations difficult, and the whole result is indecisive and disappointing.

Taking the quadrangle as a whole, nearly east and west strikes prevail, and the prevalent dip is southward. This either indicates comparatively little folding, or else isoclinal folding, or else that the foliation does not coincide with the bedding and so does not bring out the folding. It is not possible to demonstrate which of these alternatives is the true one, though the second is very unlikely, and all the direct evidence obtainable is against the third. The south dips vary widely in amount, and there is certainly considerable local folding. In spite of the uncertain nature of the result, certain facts are brought out.

The foliation is more erratic in the eruptives than in the gneisses and Grenville rocks.

In the southeast the prevalence of east and west strikes and south dips is noteworthy. In the southwest the strike has swerved to an average n. 65° w. direction, the dip remaining south. Meridional strikes are exceptional and most frequent in the central portion of the quadrangle. Locally, on the northwest, north dips prevail. There is a local prevalence of northeast strikes about the foot of Long lake. The general nonfoliated character of the anorthosite is brought out by the absence of observations in the territory occupied by that rock.

It is obvious that these observations must be extended over a wider area before their significance can be apprehended.

Joints. The number of readings taken on joints within the quadrangle limits is 647. When tabulated in respect to direction (all odd degree readings being reduced to the nearest 5° direction)

they are found to run in all possible directions [fig. 2]. In individual exposures the majority of the joints are seen to be curving instead of straight. This shows that some latitude in direction must be allowed each joint set, but is not decisive as to the amount of allowance necessary. Few exposures show more than two good sets of parallel joints, though some show three and even four. Certain compass directions are frequent in certain portions of the quadrangle, and utterly fail elsewhere, indicating a shifting of direction, rather than a different joint set, it is thought. From the best exposures it can be learned that in general there are two sets of joint couples, each couple consisting of two sets of parallel joints which

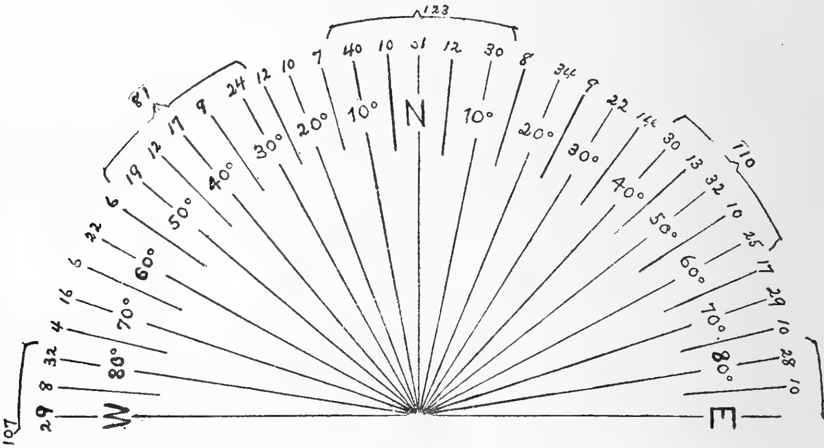
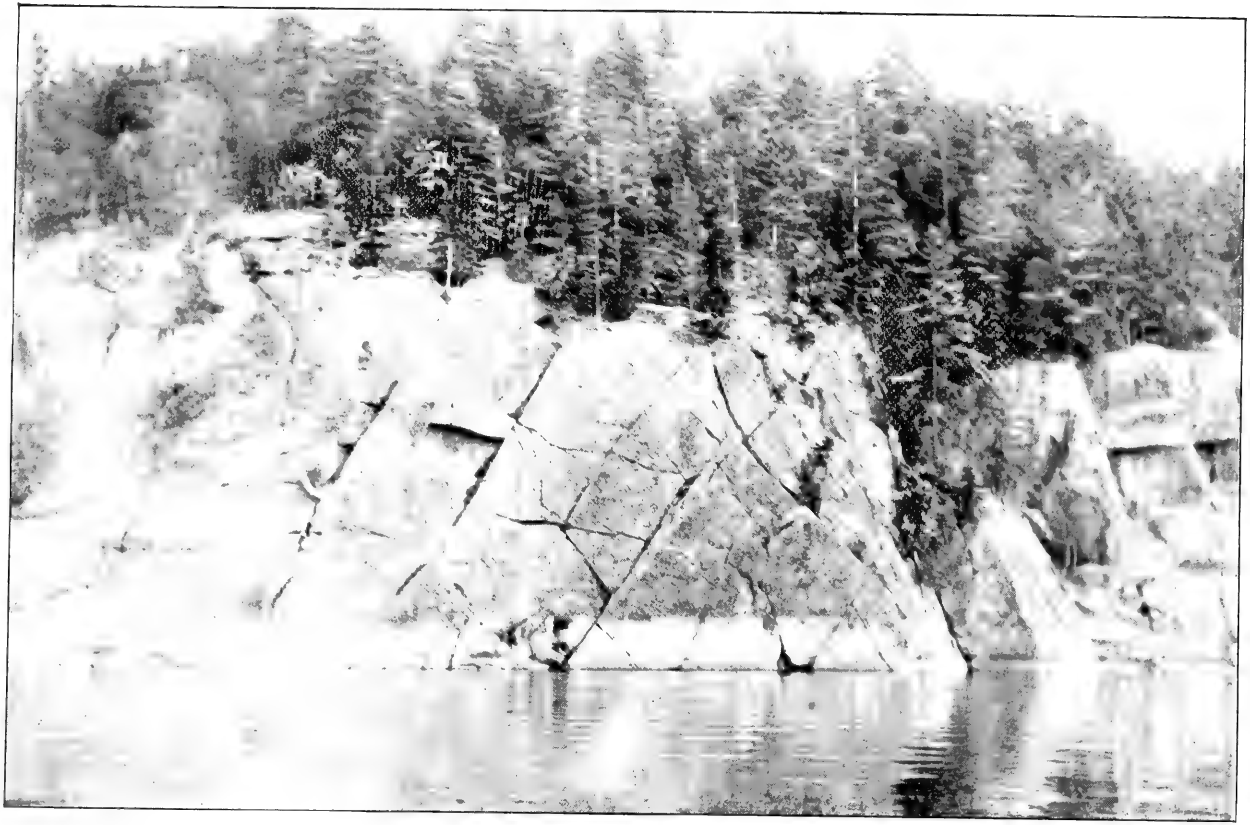


Fig. 2 Diagram of the readings on joints within the Long Lake quadrangle. The inner figures represent the compass degrees east and west of true north; the outer row the number of joint readings observed for each 5° direction. Four numerical groups are also indicated.

approximate a right angle with one another, and that one couple tends to occupy the meridional and equatorial directions, the other running northeast and northwest. An attempt may be made to classify the entire number of readings on this basis, assuming that each set has a variation in direction of 20° owing to swerve. Thus the n. 80° e. to n. 80° w. joints are grouped together, forming a couple with the n. 10° e. to n. 10° w. joints; in like manner the n. 40° e. to n. 60° e. and n. 30° w. to n. 50° w. joints are grouped. The numerical results of this grouping are indicated in the diagram, and a greater number of the readings are included, on this basis of subdivision, than on any other possible basis using the same amplitude of swerve. It is quite certain that some of the joints have a swerve of this amount, but it is not impossible that they may have even more.

Plate 4



Cliff at southwest end of Bluff island, Big Tupper lake, showing joints, the cliff face itself being along a n. 40° w. joint

This grouping still leaves a large number of not included joint readings, especially in the n. 20° e. and n. 70° e. directions. This is either indicative of two additional sets of joint couples, a n. 20° e. to n. 70° w., and a n. 70° e. to n. 20° w. couple, or else shows that the amplitude of swerve in the original couples is considerably more than 20°. If it be as great as 40° the extreme directions of swerve of adjacent pairs would meet, or overlap. But it is very improbable that the amount is as great as this.

If the region consists of faulted blocks, as is quite likely, and if the joints are older than the faults, also highly probable, then a reasonable and probable explanation of the apparent confusion would be furnished. Both hade and throw vary along faults, causing some change in horizontal orientation in the various fault blocks, which may at times become considerable, and produce an equivalent shifting in the directions of preexisting joints. Hence the prevailing joints in adjacent fault blocks might well show a lack of accord in direction, thus accounting for the prevalence of certain joints in certain districts and their absence elsewhere. For example in the southwestern part of the quadrangle the more common joint directions are n. 10° e. and n. 50° e., the latter set more variable in direction than the former. The set at right angles to the first is still more variable, from n. 80° e. to n. 80° w. in direction, while the northwest set is most variable of all, and happens to be the strike joint set. In the southeast the n. 10° w. direction is the most prominent, there are no n. 10° e. joints and but one reading to n. 50° e., the two prominent directions in the southwest. The n. 80° e. to e. and w. direction is next in prominence and is the strike joint set. The northwest set is again very variable in direction.

In the fairly massive eruptives, where there is little or no foliation, the joints are mainly highly inclined to vertical. Hades up to 20° from the vertical are common, especially in the curving joints. But there is often present a set of nearly horizontal joints, also quite irregular.

In the gneisses of the southern half of the quadrangle there is a joint set which is plainly dependent upon the foliation. This varies in general from a n. 80° e. to a n. 50° w. strike, and in many exposures good dip joints are seen whose strike is nearly or absolutely identical with that of the foliation. There are seen also to

be two sets of joints with this strike, a set of dip joints, dipping with the foliation which is to the south in general, and another set at right angles dipping north [*see* pl. 4]. These would seem quite certainly to be compression joints whose location was influenced by the foliation, but whether they antedate the vertical joints or not can not be told.

Lines of excessive jointing are not infrequent in the eruptives. In such places from two to four joint sets are well marked, and the joints are closely spaced, their distance apart being measured in inches rather than feet, chopping up the rock into a multitude of small blocks, and forming prominent lines of weakness in it. Often multiple faulting has taken place along these strips on one of the joint sets, grinding and slickensiding the rock surfaces. This faulting seems to be of Precambric age, and has been noted in several places, affecting both the eruptives and the gneisses. The entire rock complex along the gorge at Raquette falls (gabbroid anorthosite cut by gabbro) is remarkably shattered by multiple jointing of this sort throughout the length of the gorge, a distance of nearly 1 mile. At the lower end the sheared joints run n. 10° e., but elsewhere the trend is n. 40°-50° e., and no n. 10° e. joints appear. The trend of the gorge is clearly determined throughout by this joint set. There are also two sets of inclined joints, striking n. 50° w., one hading 20° n., the other 45° s. It is exceedingly probable that considerable faulting has taken place on the northeast joints.

Many excellent examples of the same sort are shown in the fine series of exposures along the roads in Litchfield park in the granites and granitic syenites. By the road along the north shore of Duck lake, about midway of the lake, occurs the most shattered material seen in the quadrangle. The rock is granitic syenite, cut by Morris granite. The slipping has been along a n. 65° e. joint set, so closely spaced as to form an excellent fracture cleavage, considerable secondary quartz has been deposited, and the rock rapidly weathers down to a mass of fine splinters, strongly resembling rotted wood splinters at a little distance, all due to excessive shattering, accompanied in all probability by faulting.

Faults. It is not easy to demonstrate the presence of faults in districts whose stratigraphy has not been deciphered and to definitely locate them and determine their magnitude, in such areas, is well nigh impossible. It is however known that faults are fre-

Plate 5

Near view of the steep south face of the Mt Morris spur. The cliff rises quite sheer for some 800 feet and is probably a fault scarp

quent and important structural features in the Paleozoic rocks which fringe the Adirondacks; that they most abound on the east; that on the north and south they diminish in number and magnitude going westward, and that on the west they are small and infrequent. It is also known that they are normal faults with nearly vertical hade; that many of them have throws of several hundred feet (some of from 1000 to 2000 feet); that the principal ones run north to northeast; that there are numerous cross faults running west to northwest; and that from the Paleozoics they run into the crystalline rocks with their magnitude unimpaired. A priori therefore their presence should be expected in the Adirondacks, and they should diminish in importance westward through the region.

The Long Lake quadrangle is in the mid-Adirondack region. In the Mohawk valley large faults are found considerably west of its meridian, the Little Falls fault, longitude 74° 50′, being the most westerly of the large faults there, and with an average north-northeast trend. Faulting on that trend, prolonged into the Adirondacks from Little Falls would involve the Long lake region, and some evidence of faulting would naturally be expected, though not as prominently as would be the case farther east.

Actual evidence of faulting is furnished by the slickensided character of the multiple joint surfaces previously described, but this seems to be faulting of very ancient date, and is not the common type of faulting here under consideration.

The indirect evidence for faulting in the district is twofold.

1 *Topographic.* As repeatedly urged by Kemp for the more faulted district to the east the shape of the ridge blocks, a gentle crest slope in one direction and a steep cliff face in the other, is strongly suggestive of block faulting, and indeed no other reasonable explanation suggests itself for it. Fault scarps of the sort appear in the Long Lake quadrangle. The great cliff on the south side of Mt Morris [*see* the topographic map and pl. 5] is one such, and is one of the most conspicuous examples in the whole region. The two big ridges to the southeast of Mt Morris are also of the block-faulted type [pl. 19]. But on the whole this type of ridge is not especially prominent within the quadrangle, or at least recent faulting of the sort is not suggested outside of the examples mentioned. Others of the ridges do somewhat suggest more eroded examples of the same type.

2 *Grenville belts and patches.* To explain the situation of some of the Grenville rock belts, inclosed on both sides as they are by the later eruptives, it seems necessary to assume that they lie in downfaulted troughs. They now constitute valleys with the eruptives forming the adjoining ridges, as well as underlying the Grenville at an unknown depth in the valleys. This makes a considerable and quite abrupt change in the level of the upper surface of the eruptive. Unless these are downfaulted troughs it seems necessary to assume this curiously irregular upper surface to the igneous batholite, so that the other supposition seems vastly the more probable.

The areal mapping seems to emphasize this suggestion, though the evidence has not the weight it would have in a district whose stratigraphy was well worked out. The boundary between the Follensby-Cold River Grenville and the anorthosite and syenite which adjoin it on the northeast, appears to be a fault contact, though the Grenville exposures are not frequent enough to enable exact mapping. The boundary between the Moose creek-Bog stream Grenville, and the syenite and gneisses to the north, is also suggestive of faulting. Too little is known of the relationships of the Grampus gneiss to warrant any deductions from the mapped contact between it and the Grampus Grenville.

TOPOGRAPHY

The main axis of elevation in northern New York bears south through western Clinton and Essex counties to the Marcy region, then swerves to a southwesterly trend which is continued through Hamilton county. This line forms the major axis of the Adirondack highland. From it the surface drops gently westward toward Lake Ontario and the St Lawrence; from it the surface drops more abruptly and jerkily eastward to Lake Champlain. The minor axis of elevation passes westward through Essex and southern Franklin counties, intersecting the other in the Mt Marcy region. The general highland of the northern half of the Long Lake quadrangle constitutes the western portion of this minor axis, while the entire quadrangle lies west of the major axis.

In northern Hamilton two broad valley regions cross the major axis separating the Hamilton from the Essex portion. One of these valleys is certainly and the other probably located on a belt of Grenville rocks. The lowland along the southern margin of

Looking south into Hamilton county, from a hill summit in Litchfield park, Franklin county, with Duck lake in the mid view. The line between the two counties passes through the south apex of the lake. The comparatively even sky line given by the ridge crests is well shown and the broad valley in the foreground, the pond lying at one edge is quite typical.

the Long Lake quadrangle constitutes the northern portion of the first of these lowland belts. A similar, though less conspicuous lowland belt is developed across the south center of the quadrangle, again located on the Grenville rocks, and separating the two highland areas of the quadrangle.

Peneplains. It has been elsewhere shown to be probable that, during Mesozoic time, the Adirondack region was worn down to a comparatively even surface or peneplain, which was subsequently uplifted, and that the accordant levels of the hill and ridge tops and crests observable in the southern and western Adirondacks are due to the fact that they are remnants of this old surface.[1] The uplift renewed erosion and the present broad valleys of the region were cut out, the comparatively concordant levels of their bottoms marking the new base level, and their depth below the peneplain horizon measuring the amount of uplift. Since their development there has been further uplift of the region, the old valley bottom level is no longer the stream grade, and the streams are now engaged in the task of cutting down to the new grade, in which task they have made but slight progress.

All these uplifts have somewhat tilted the old peneplain surface though the amount of tilting is but slight, and in the southern and western regions the even sky line of the ridges is everywhere notable. But on the northeast the ridge tops appear at varying altitudes and hardly suggest a peneplain surface. This is thought to be due to renewed faulting during the more recent times of uplift, giving the various fault blocks differing altitudes, and destroying their previous concordance of surface. It seems also to be true that monadnocks, or parts of the old surface which were never worn down to the general peneplain level, are larger and more abundant in the vicinity of the main axis of elevation than they are elsewhere, and this makes an additional obstacle in the way of recognition of that surface.

The probability that faulting has played some part in the production of the present topography of the district, though by no means as important a part as it has farther eastward, has already been indicated. Therefore more evidence of former peneplaination should be observable here than there. An inspection

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[1] N. Y. State Mus. Bul. 95, p. 423–27; Ogilvie, I. H. N. Y. State Mus. Bul. 96, p. 468–69.

of the topographic map shows that in both the northern and southern highland areas the hill summits tend to elevations of from 2600 to 2800 feet, with the Kempshall and Morris summits alone overtopping that elevation as small monadnocks [pl. 5, 6, 14]. A study of the topographic maps of the adjacent quadrangles however quickly dispels the impression that we have here a peneplain level which can be shown to extend over any considerable area. On the St Regis quadrangle, just north, but a single hill (St Regis mt, 2882 feet) exceeds 2600 feet elevation, and there are but two others which reach 2500 feet, most of the hills ranging from 1900 to 2200 feet. There is further seen a range of hills running across the quadrangle from northeast to southwest east of which lies a depressed belt, the lake belt, in which the hilltops little exceed 1800 feet, yet the rock is anorthosite, as it is in the higher range to the west. This lake belt seems a downfaulted trough, and its southward prolongation forms the northwest portion of the Long Lake quadrangle. The altitudes of the hill range are fairly concordant with those of the highlands on the Long Lake quadrangle. In both the valley levels are near 1600 feet, indicating that the dislocation of the peneplain surface by faulting dates mainly from the time of the first uplift which followed its formation.

On the Santanoni quadrangle, adjoining the Long Lake on the east, there are several peaks over 4000 feet high, the main watershed of the region appears, and we are carried at once into the high Adirondacks. There are no elevations concordant with those on the Long Lake sheet, and there are many things which suggest considerable faulting. Because of proximity to the watershed the valley levels are also higher, but seem fairly concordant, taking this into consideration.

South, on the Blue Mountain quadrangle, are many peaks with altitudes well over 3000 feet, with Blue mountain, 3759 feet, overtopping them all. There are also many lower hills which are more in accord with the general Long lake altitudes. Whether the higher hills are to be classed with Kempshall and Morris as monadnocks, in which case they would be very numerous, or whether they represent the peneplain level, dislocated out of accord with the Long lake levels, is not certain.

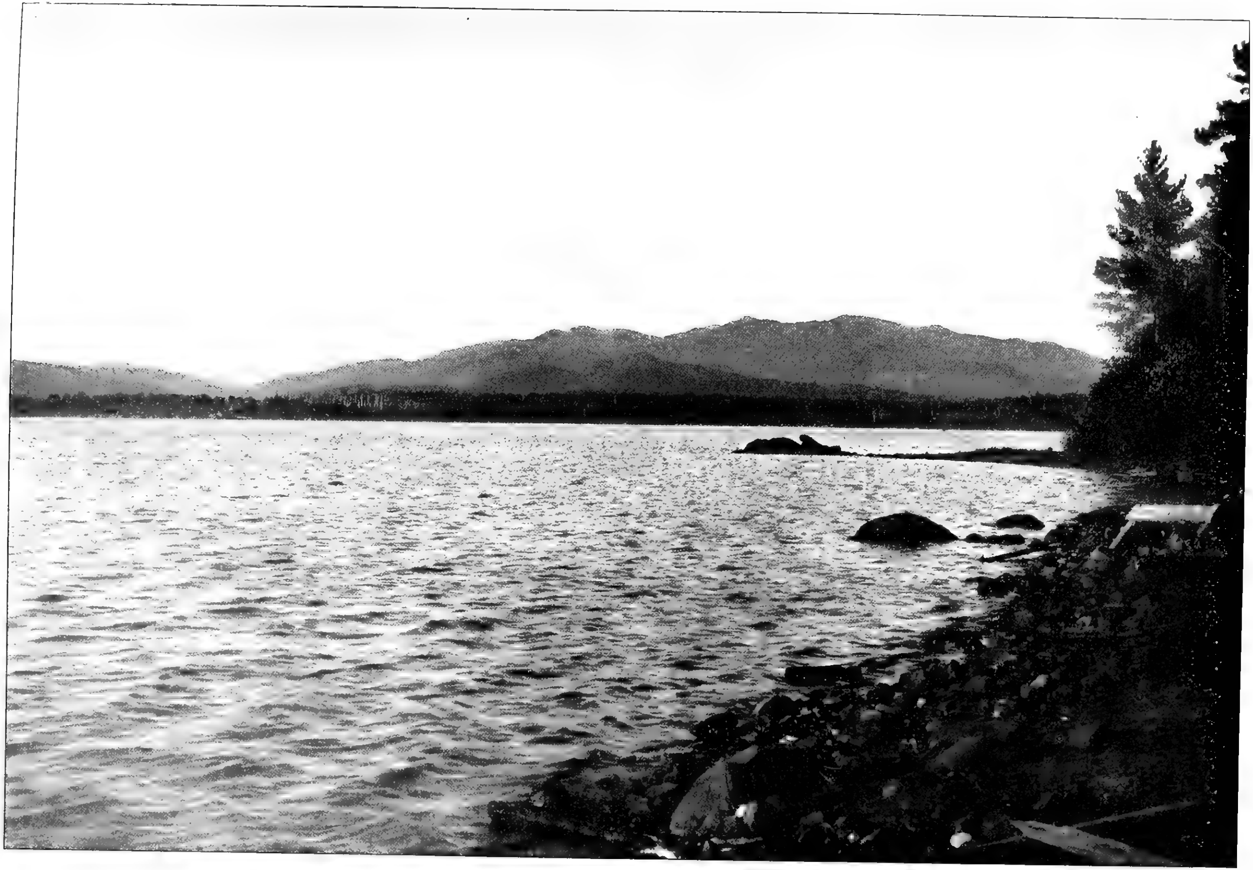
Topography as conditioned by the rocks. Owing to their weak resistance to erosion, in comparison with the other rocks of the region, the Grenville rocks give rise to valleys, and the main

Plate 7

The Mt Morris mass from the west showing the fairly even sky line of the ridge crests and the slight elevation of the summit knob above this level. At the right of the summit knob appears the upper part of the cliff which terminates the mountain on the southwest.

Plate 8

Mt Kempshall and the intervening ridges, from the Island House. All are of Long Lake gneiss and illustrate its topography.



The Seward range from the Island House, Long lake; the Raquette valley notch on the left, with Ampersand mountain in the far distance. All the ridges in the view are of anorthosite

valley belt of the quadrangle is a Grenville belt. Because of the greater strength of the quartzite member of the series, it gives rise to considerable hills in each of the belts, but otherwise they are low. It is quite likely, too, that the lowland along the southern margin of the sheet, and that about Round pond, is really Grenville territory. The few exposures seen in each area are of uncertain gneisses, and do not suffice to definitely determine what the prevailing underlying rock may be. Except for the lowland along the north margin of the sheet, which belongs to the lake belt and is likely due to down faulting, the main lowlands are owing to the presence of Grenville rocks and their weakness.

The hills tend to the long ridge type with their major axes trending northeast-southwest. Those which suggest faulting have a northeast pitch to their crest, and a steep, clifflike back slope on the southwest, as seen on Mt Morris and on the ridges east of Little Simons pond. Stony Creek mountain shows an approach to the same type. On the other hand the long, irregular ridge of Rock Pond and Grampus Lake mountains does not at all suggest the type, and the Kempshall mass is not even of the ridge type. There is a tendency on the part of the elevations in the gneiss country to be of the hill, rather than of the ridge type, as illustrated by Mt Kempshall and Buck mountain, while this type is practically absent in the anorthosite and syenite country [pl. 7–9].

Drainage lines. In so far as there are belts of weak Grenville rocks, the valleys so located are drainage lines, whose trend is determined by that of the Grenville belt. Moose creek, Bog stream, lower Cold river, and the Raquette between Cold river and Moose creek, are the principal streams of the quadrangle occupying Grenville valleys. In so far as the remainder of the water courses are concerned, the lines of weakness which they occupy must be structural rather than stratigraphic, hence must be lines of jointing and faulting. Hobbs has recently presented strong arguments for the belief that such lines have had predominant influence in the location of the drainage lines of New England and Eastern New York.[1] But it is difficult to apply the argument in a district where joints are found with all possible compass directions, as they are within this quadrangle. Yet, as has been pointed out, there are certain directions of more frequent, and more important

[1] Jour. Geol. 1901. 9: 469–84; Geol. Soc. Am. Bul. 1904. 15: 483–506.

jointing and it is of interest to ascertain whether those directions are also the more usual directions of the drainage channels. Since faults have not the prominence that they have to the eastward, they can not have the important effect upon the drainage that they there have.

The two prominently linear drainage lines of the quadrangle are the Long lake, and the Raquette-Upper Saranac lines. The trend of Long lake throughout its 13½ miles of length is closely n. 35° e., nearly half of the lake being on the Blue Mountain quadrangle. Above the lake the Raquette follows the same trend line for at least 2 miles more. Below the lake for a mile we have the Raquette and Cold rivers on the same line, beyond which Calkins creek follows it for 5 miles more; in other words for 21 miles this is a linear drainage line. Other lines, though shorter and less prominent, have the same trend; the line containing Rock pond, Second and Third Anthony ponds, and their inflowing creeks for one; Grampus and Handsome ponds and the main tributary to Upper Moose creek form another; the Raquette from the mouth of Moose creek to the landing below the falls is equally linear though not quite parallel, the direction being n. 45° e. This is the most prominent drainage direction in the southern half of the quadrangle. It is even more prominent to the southeastward, the Indian lake-Upper Hudson line having the same trend.

In the northern half of the quadrangle the meridional direction is the more conspicuous. The most prominent line of the sort is that followed by the Raquette river from the falls to Axton, then across to Upper Saranac lake, the valley being blocked by drift sands between the two points. The lake, 7½ miles long and trending north and south is on the same line. Follensby pond, with its inlet and outlet, and the Raquette river below as far as Tromblee's, constitutes another such line. These straight courses would all seem to be determined by lines of jointing, and likely of multiple jointing and slip faulting. It is certainly true that the meridional joint direction is the more important in the northern, and the northeast direction in the southern part of the quadrangle, and these drainage directions are in accord with this.

The east and west direction for the tributary streams is the more common one in the district, though this prominence is vastly better brought out on the Blue Mountain quadrangle than on the Long Lake. Here the line of Ampersand brook and the Raquette river

from Axton to Follensby outlet is the most important one. The Bog stream and Big brook stream have the same alinement. The northwest direction is uncommon, though it becomes the prevailing stream direction in the quadrangles to the northwest. But in these the faulted district has been left behind, and the streams seem to be consequent streams.

GLACIATION

Striae. The location and direction of the glacial striae noted within the quadrangle limits are indicated upon the accompanying map, with two additional readings just outside these limits to the west. All are found by roadsides, upon recently stripped ledges. But the larger number of the rock exposures elsewhere show glacial rounding and polish, the striae being obliterated by the weather. The fact that recently stripped exposures show them with great frequency, seems to indicate that they were abundantly produced within the district. Further, all seen are in valleys, and some of them in valleys whose trend is at right angles to the direction of ice motion. Ogilvie has urged that, in the high Adirondacks, glaciation was comparatively feeble and mainly effective upon the hilltops, the ice in the valleys being comparatively stagnant.[1] But if this be true it can only be so for a very restricted area, since the Long Lake quadrangle closely adjoins the high district, and the valleys show abundant evidence of considerable glaciation.

The 10 readings on striae shown on the map vary in direction from s. 25° w. to s. 75° w. While plainly influenced by the valley trends they harmonize well with the statements of Kemp and Ogilvie that the general direction of ice motion across the Adirondack region was a southwesterly one. Six of the 10 are in harmony with that statement. The other four, the two on the north shore of Jenkins pond, the one by Little Simons, and one of those outside the sheet, are influenced by, and have closely the trend of the valleys in which they lie. More striking instances of similar deflection are shown on the Tupper Lake quadrangle, next west, where, on stripped ledges along the railroad, readings of n. 80° w. and n. 75° w. were obtained, parallel to the trend of the Raquette valley. The general southwest direction also holds on that quadrangle, and there also striae are found numerously on recently stripped ledges.

Glacial deposits. No heavy and thick deposits of till have been noted within the quadrangle limits, nor any bulky moraines. There

1 Jour. Geol. Apr. May 1901. v. 10; N. Y. State Mus. Bul. 96, p. 470.

is however often a respectable amount of till, and many areas are at least thinly covered with morainic material. But on the whole glacial removal seems to have been in excess of glacial deposit.

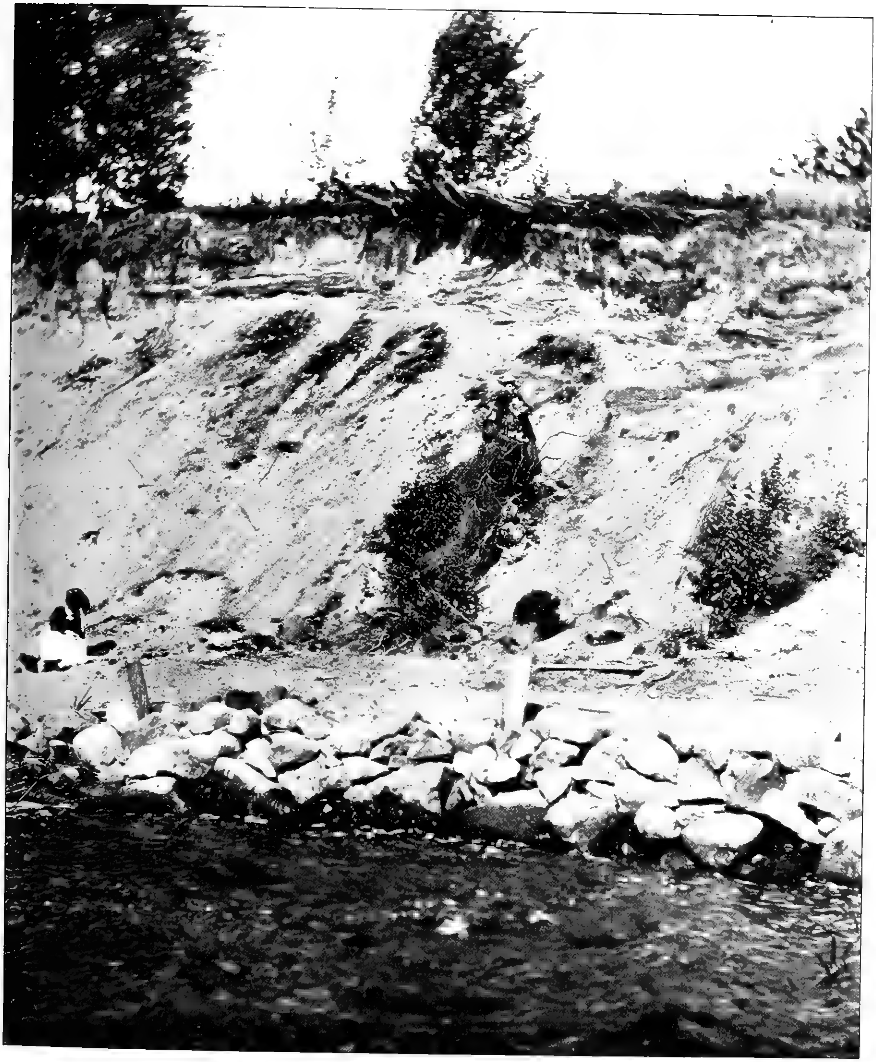
The main areas of morainic accumulation are shown on the accompanying map, though not fully, only those sufficiently extensive to render the areal mapping somewhat uncertain being shown. It may be said in general that the main valleys all have their floors banked up with drift, and that the north slopes of the ridges are apt to be similarly encumbered. The matrix of the deposits is quite sandy, or gravelly, as is usual in the Adirondacks, but they contain many large boulders, and there are often large boulder trains on the surface.

A moraine of considerable prominence runs across the northern portion of the quadrangle from Tupper lake to Axton and beyond. There is a tendency to kame development along its front, as is common in the district, and at Moody is a notable instance of the sort [*see* map and pl. 10]. The waves of the lake have eaten away its end producing a 20 foot sand bluff, showing cross-bedded sands with a coarse gravel streak near the top. A short distance back it runs up to a conical summit, 150 feet above the lake. Yet further east it runs up against the moraine, two flat terraces appearing during this rise, their surface covered with gravel and occasional cobbles, but no large boulders. This fringe of water-laid material borders the moraine on the south for a considerable distance. About Tupper Lake Junction is another development of sands, and Little Wolf pond, whose southern shore appears at the north margin of the sheet, is held up at the south by these sands. A great sand and gravel terrace, with occasional large boulders extends up the Cold river valley, banked up against the anorthosite hills beyond, and seems a true kame terrace.

The broad Grenville valley belt of the quadrangle is rather heavily moraine covered. The local character of the drift is emphasized here since Grenville boulders abound, but elsewhere are scarce or absent, so that they can be used rather confidently for areal mapping. Throughout the gneissic area also the low grounds and the gentle hill slopes are moraine covered. The accumulations are in general not large, nor do they tend prominently to the ridge type. There is no indication within the quadrangle limits of any protracted pause during the ice withdrawal.

Numerous cuts in till are shown along many of the roads, espe-

Plate 10



Bluff produced in kame sand ridge at Moody, Tupper Lake shore. Cross-bedding shows midway at the top.

cially in the northern half of the quadrangle. It is quite sandy or gravelly in character, and has been much used for surfacing the roads, answering fairly well for that purpose in many places.

Valley plains and pitted plains. In the district north of the Long Lake quadrangle there is evidence of pause in the ice retreat, in the considerable moraine which runs west from Placid to Saranac, and thence on northwest to Lake Clear and Brandon. Running southwest from this is a great sand-filled valley, commencing at Lake Clear and ending at Tupper Lake Junction. The general character of its surface is well shown on the St Regis quadrangle topographic map. A number of small rock knobs project above it, and the railway cuts west of Saranac Inn station well illustrate the general way in which these knobs are wholly or partly drowned in the sand. The material is mostly even grained sand of medium grain. There is little gravel in it and no clay.

In addition to the rock knobs the surface shows diversity of another sort, small oval or circular depressions below the general surface which are in some cases dry and in others occupied by small ponds. There is a notable collection of these between Upper Saranac lake and Lake Clear, and thence northward to Upper St Regis lake and beyond. It is exceptional that a topographic map brings out the feature better.

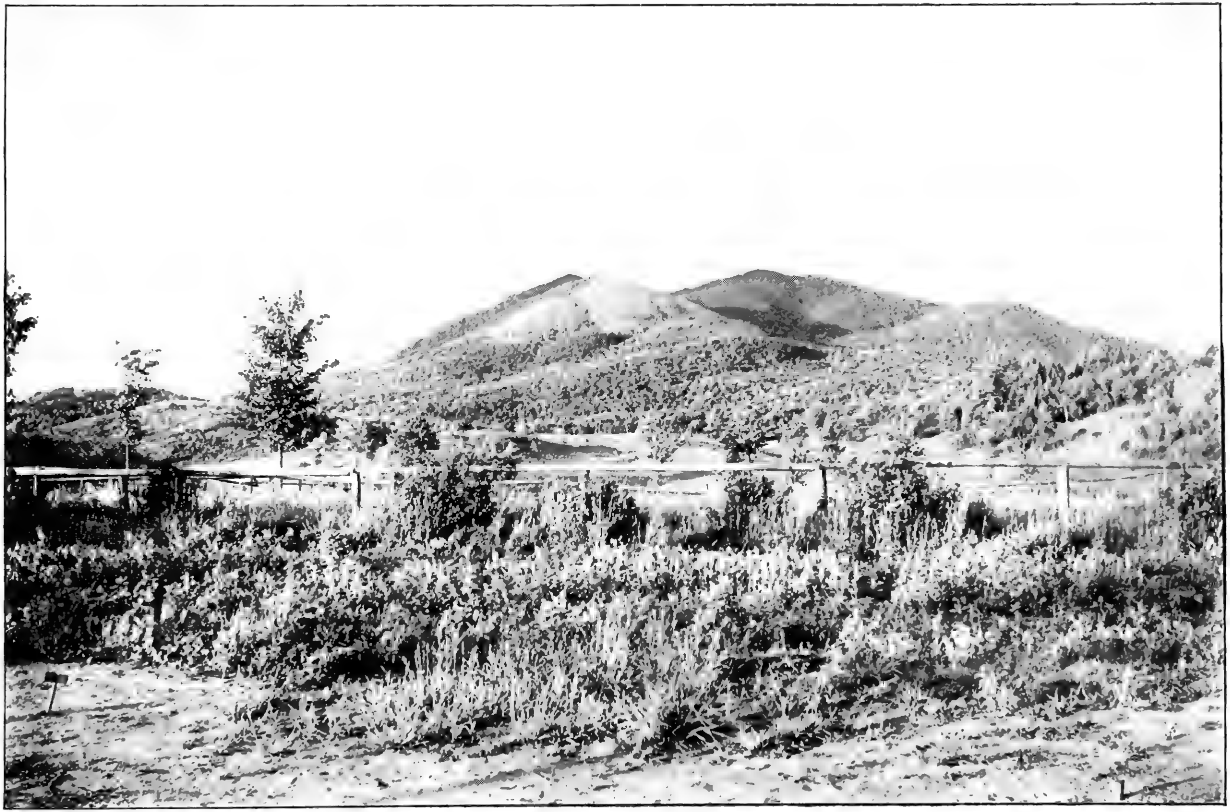
The general area is also noteworthy in the number of lakes and ponds. There are about 150 of these in the St Regis quadrangle, in all probability a greater number than is found on any other of the Adirondack map sheets. And they are mainly massed along this sand belt and occupy depressions in its surface. The upper end of Upper Saranac lake has these sands for its shores, and the abundant and good sized ponds to the westward have also sandy shores except for the occasional rock knobs protruding through the sand. The general level of the deposit falls to the southwest though the fall is only slight, from 12 to 18 inches to the mile. The sand must have been deposited from a current which ran across the region to the Raquette just below Raquette pond. In order to account for this flow we must presume that the present outflow through the Saranac river was blocked, and it would seem that it must have been blocked by ice which lay near at hand. The depressions in the sand are of the kettle hole type, and the fact that the larger ponds were not filled by the sand suggests that they were occupied by stagnant and slowly melting ice tongues

which persisted until after the melting back of the main ice front withdrew the water supply from this particular channel. The subsequent disappearance of the ice tongues left the basins occupied by the present ponds. The small kettle holes were likely formed in the same way, small unmelted ice masses being left during the general retreat of the front, covered with sand and subsequently slowly melting away. The Upper Saranac lake valley was likely occupied by the largest tongue of all, and the sands were washed upon its north end but were otherwise kept out of the valley. If this be the true explanation of the character of the district it follows that the ice disappeared from it by melting back toward the northeast and that, for a time, the Raquette river carried the upper Saranac drainage.

There is another and parallel line of identically the same nature on the St Regis quadrangle, extending from the Forestmere lakes down to Bay pond and beyond, with a tributary line coming into it from the north at Brandon. The sands are similar and the surface characters identical. The writer is not familiar with the district to the west and does not know whether a connection with the Raquette drainage can be traced or not. The flow may have been down the St Regis.

There are two small sand-filled channels, one wholly and one partly on the Long lake sheet. The former extends from Coreys to Axton, the route of the old Indian carry. The material is mainly sand though there are a few gravel streaks. A few surface boulders are to be seen, but very few. The surface partakes somewhat of the kame character and this was likely a channel of water discharge only during the time that the ice was retreating back over it. It is this sand filling which prevents the water of Upper Saranac lake from coming south to the Raquette river, to which drainage it properly belongs, and sends it through the modern channel, over the rock ledge at the Saranac Club (Bartletts carry). The other channel comes down to the Raquette river at the oxbow 1 mile below Tromblee's (not the Oxbow further downstream) and takes off from Upper Saranac lake at Gilpin bay. It seems also a local channel, used for a short time after the abandonment of the previous one, and before the ice had withdrawn to the north of Upper Saranac lake, opening up the great channel decribed previously.

Topography as modified by glacial erosion. The all pervading effect of glacial wear in the region was the rounding off, smoothing and polishing of the rock knobs, large and small [pl. 1–3]. Except



Stony Creek mountain from Axton, looking east northeast. Distance to the summit 3¼ miles. The mountain is not of the typical ridge type though it approximates it. It broadens out on the southwest and sends out two spurs with a deep amphitheater between.

Main fall in the gorge at Raquette falls. The rock is the border, gabbroid phase of the anorthosite and is excessively jointed and sheared

in a few protected situations all previously weathered rock was worn away, and the present day surfaces are of rock which is fresh except for the slight amount of postglacial weathering. The ice was thickest over the valleys, whose sides were notably smoothed and whose bottoms may have been deepened, though no demonstrative evidence of this has been noted. That the valleys deflected the direction of the ice movement in its basal portions to parallelism with their trend, has already been shown.

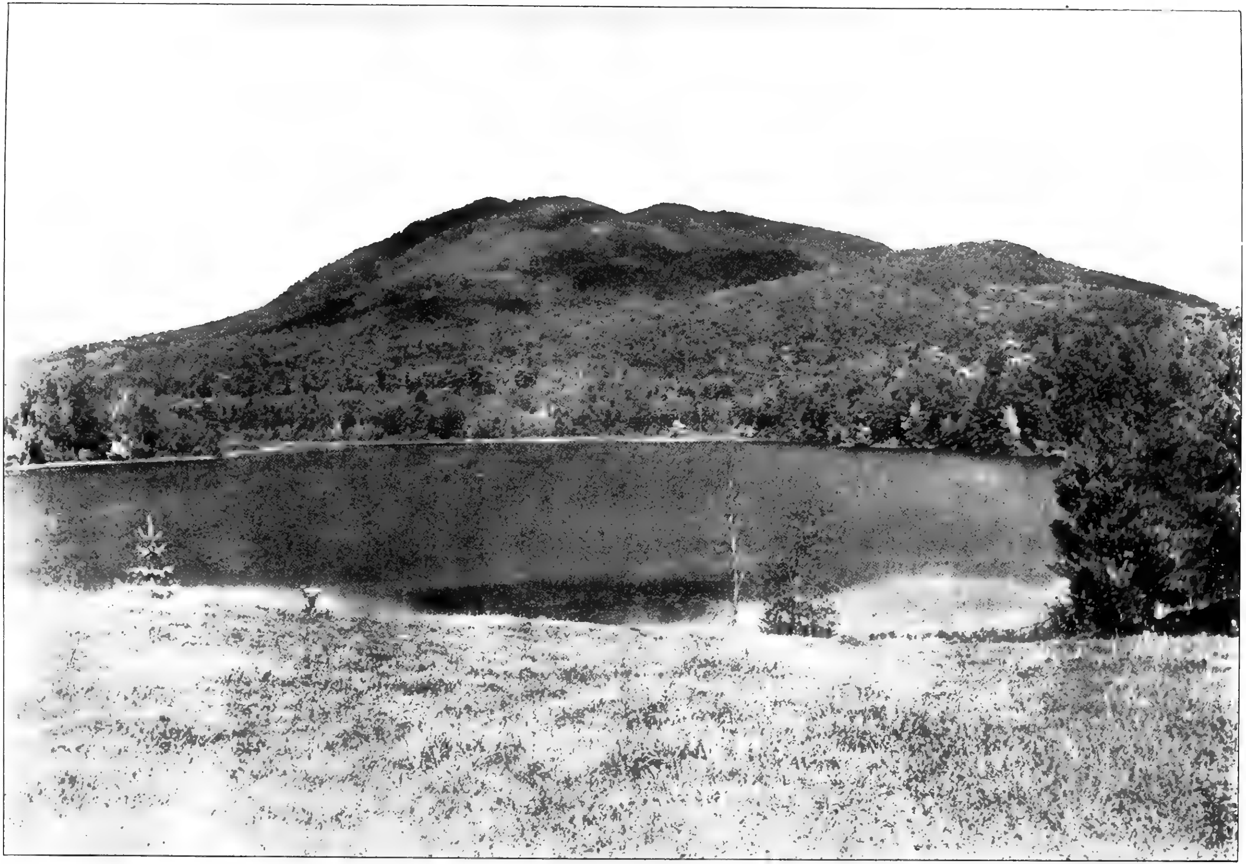
The pronounced topographic effects produced in lofty mountains by great ice streams, as many believe, are not to be seen in the region, unless to a very trifling extent. There has been some local sapping of cliffs by bergschrund action, and some tendency to the production of amphitheaters and cirques on the higher ridges. Seward pond, midway on the east margin of the quadrangle, seems a small cirque pond, but is the only sample of the kind within the quadrangle. There are however a dozen of the type in the more lofty and hilly Santanoni quadrangle next east. The two amphitheaters on the south face of Stony Creek mountain seem due to the same sort of plucking action though no basin was dug out by the ice at the foot of the slope [pl. 11]. Some of the lower level ponds may occupy rock basins dug out by the ice, though there is no evidence at hand that this is the case. In the case of the larger lakes it is quite possible that the ice may have done some excavation on their beds. Long lake trends with the ice motion and may be a rock basin dug out by the ice. But it seems equally well accounted for on the supposition that its drainage went out to the east in preglacial times, and that drift filling in the valley east of Long lake blocked the channel and sent the water over the preglacial col at Raquette falls. Certainly the greater number of the ponds of the quadrangle, both large and small, occupy hollows in the moraine or overwash sand plain surfaces, or else drift-blocked hollows in the partly drift-filled preglacial valleys. The amount of drift deposited in the valleys is considerable; not so much but that frequent rock knobs protrude above it, but sufficient to everywhere hide the rock floor, and sufficiently variable in amount to give rise to many ponds.

Drainage modifications. The entire area of the Long Lake quadrangle drains into the Raquette river, except for a small district in the northeast corner, draining into the Saranac, and a somewhat larger one on the southeast, which sends its water to the Hudson.

Except locally, the present stream valleys were also preglacial stream valleys, and the principal modifications in the drainage produced by the ice, in addition to the formation of lakes, were in shifting the divides. A moment's inspection of the topographic map suffices to show that many of the divides thereon are of the most trivial character, and are unstable. A drift-filled valley less than a mile long is all that separates Upper Saranac lake and Stony Creek pond, whose water level is 26 feet lower and which outlets by a sluggish stream into the Raquette river just above Axton. The preglacial drainage here would seem most likely to be that of a west-flowing stream in the Ampersand brook and Raquette valleys, with a tributary from the south in the present Raquette valley whose source was at Raquette falls, and another tributary from the north in the Upper Saranac lake valley. The Raquette has been a rapidly aggrading stream from below Raquette falls to Tupper lake, but shows rapids and falls a few miles below where it is out of its old channel.

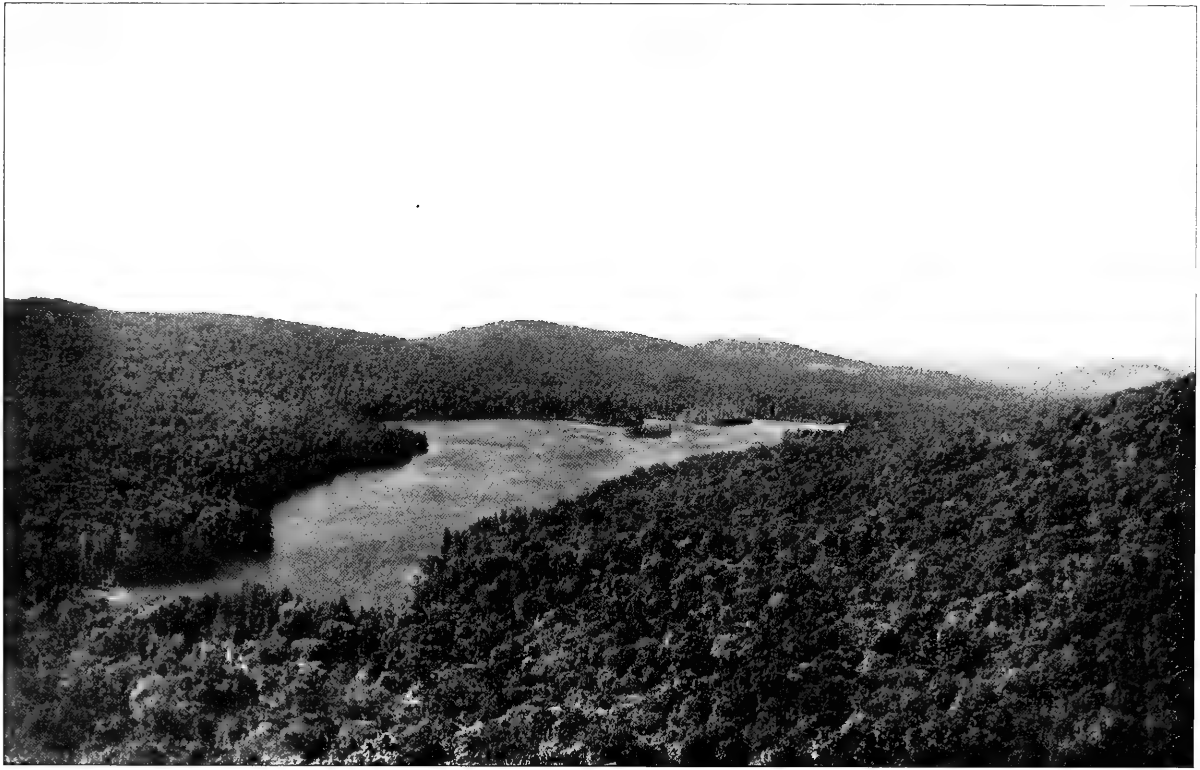
The divide between Long lake and Round pond is less than 20 feet above the water level of the former and is a low drift divide. The waters of Catlin lake are 33 feet below those of Long lake, and from it there is a modern water route to the Hudson. There is similarly a valley across to the Hudson drainage commencing near Long Lake village, on the Blue Mountain quadrangle, which is a drift-blocked channel, though with a greater drift altitude than in the previous case. It would seem that one or the other of these valleys was the outlet for the preglacial drainage of the Long lake valley, above it the water flowing north and below it flowing south, the divide being at Raquette falls; or in other words the preglacial divide between the Hudson and Raquette waters was here. Abundant similar examples of modern divides of the most trivial character and composed of glacial drift can be seen on the neighboring quadrangles.

The immediate district is up near the main watershed of the region. Lower down in their courses the main streams are out of their preglacial channels here and there and are held up by the rock barriers developed in these new courses. Owing to the slow rate of progress in cutting through these the headwater portions of the drainage channels have slight fall and little cutting power, and divide shifting must in the main be delayed until these lower portions of the streams have deepened their channels.



Lower arm of Stony Creek pond; a pond occupying a depression at one side of a glacial stream sand deposit. Stony Creek mountain beyond

Plate 14



Jenkins pond (Lake Madeleine), Litchfield park, a long sinuous pond occupying a narrow preglacial valley and held up by morainic deposits at its west end. View taken from the anorthosite knob to the northeast

From the present main elevated axis the steeper and shorter stream slopes are those toward the east into the Champlain valley. There is hence a tendency on the part of the east-flowing streams to push their head waters across the divide and establish a new stream divide to the west of the elevation axis. Two great valleys had been pushed through the axis in preglacial times, on belts of weak Grenville rocks and, as stated above, much of the present Raquette drainage above Raquette falls seems then to have gone out to the eastward, and has been turned back to a westerly drainage system by uneven glacial deposits. The Saranac is the only present day stream going to Lake Champlain which crosses the main axis. It is quite certain that in the future others will do the same thing, unless again retarded by further uplift on the east.

Postglacial topographic changes in the region have been comparatively slight. A slow uplift of the district has been in progress so that the drainage has had a changing base level throughout the time. The streams, where out of their old courses, or where across old cols, have developed falls and rapids with gorges below, but the rocks are mostly very resistant, even the largest of the streams are of only moderate size, and toward their head waters they are often filtered clear of sediment by passing through lakes. These things all combine to make the amount of postglacial cutting comparatively slight. Locally the streams have aggraded their valleys, sometimes because of a reversal of direction, at others because of being turned out of their old valleys locally by drift obstruction. Much of the Raquette valley within the quadrangle is of this character. It is a meandering stream on a wide valley floor, bordered by mud banks which fall off to swamps away from the stream, and with frequent cut-off meanders in all stages of filling [pl. 20].

A considerable amount of lake filling has also been done, as a moment's inspection of the map will show. The present Tupper Lake reservoir is simply the reexcavated portion of a former pond which had been entirely converted into swamp. It is an interesting locality in that there is a well preserved old shore line on the north side marking a former water stage 10 feet above the present. This shore is marked by a boulder accumulation, concentrated there by the washing away of the associated finer material by the action of the waves.

Even the largest of the lakes are not sufficiently large to permit

of the production of waves powerful enough to have an important shaping action upon their shores. Bare rock ledges are a feature of the shores of most of them. Elsewhere they are largely of boulders washed out of the moraines, upon which the waves have a little more effect than upon the ledges. Little deltas appear at some of the brook mouths. Where kame or valley sands form the shores rapid cutting is in progress and rapid shallowing as well. One prominent sand spit has been developed on the Long lake shore in the lee of Camp island [pl. 15, 16], with others of less prominence to the south.

ECONOMIC GEOLOGY

If the district was, or was ever likely to become, a thickly settled one there are some things that might have considerable economic importance; as it is there is little of that nature. Aside from its iron ore the Adirondack region shows little or nothing in the way of metalliferous wealth. Within the area of the quadrangle no deposits of iron ore were seen, nor have any ever been exploited, so far as could be discovered, though such are known from all of the adjacent quadrangles, of which the titaniferous ores about Lake Sanford within the Santanoni quadrangle are much the most important.[1] These ores are found in the anorthosite and result from its differentiation, but there are none such found within the anorthosite area of the Long Lake quadrangle except possibly of such minor size that they have been missed during the present survey. Nor have magnetite ore bodies been noted within the areas of gneiss and syenite, in either of which they might occur. In the district between Raquette Falls and Follensby pond there is some local compass variation, though it is hardly indicative of any large ore body.

There is considerable graphite in disseminated form in the Grenville rocks, both in the sediments and locally in the igneous rocks, as is usual in the formation, but nothing was seen which would indicate that it is anywhere present in sufficient quantity to form a workable deposit.

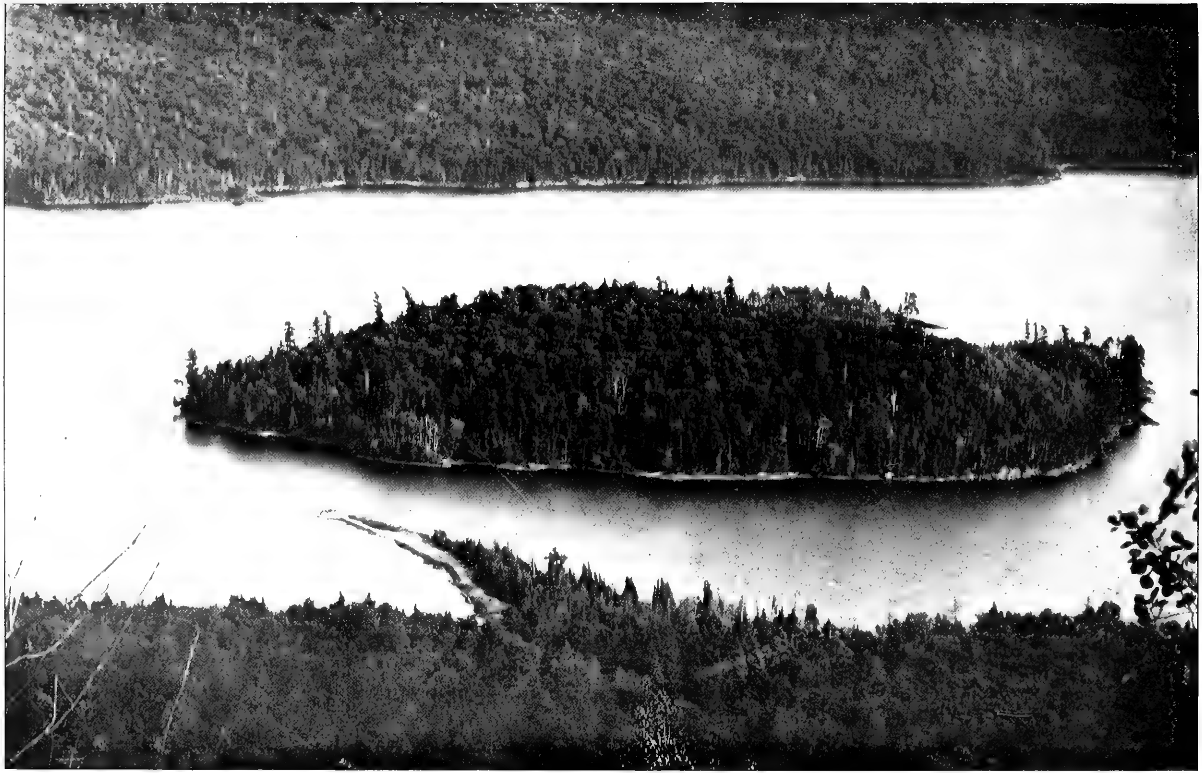
Building stone. In the granite, syenite and anorthosite areas of the quadrangle there is an inexhaustible supply of building stone of fair quality, and much of the granitic Long lake gneiss can also be used for structural purposes. It is not likely that any of the stone is of such high grade that quarrying operations on a large scale for export would be advisable, but there is an ample supply of material

[1] Kemp, J. F. U. S. Geol. Sur. 19th An. Rep't, pt 3, p. 409–19.

Plate 15

Looking across Long lake from near the summit of Buck mountain; showing Mt Kempshall and Blueberry mountain, the Camp islands and the sand spit running out from the west shore toward the southerly end of the islands; the Sabattis range in the distance

Plate 16



Enlarged view of part of plate 15 to better show the sand spit

for all possible local use. Perhaps the best material of all is the red, granitic syenite, the color of which is pleasing, and not susceptible to the change which the green syenite experiences. The handsome lodge and gate at Litchfield park are constructed of this material, and a prettier red granite would be hard to find [pl. 17]. The material was obtained from boulders within the park, and close at hand, but there is a plentiful supply exposed in places to the east. In all respects except that of color much of the syenite is an equally good building material, and its original greenish shade is a pleasing color to many; but its rather rapid change to brownish tints on exposure to the air is a drawback. It has been used for foundation and other work at Tupper Lake to a considerable extent and for durability and strength is unexcelled. The color change is the only drawback to its use for more pretentious work.

The anorthosite is also a strong, durable stone serving well for all rough purposes. The coarser varieties have had considerable use in the region in the construction of rustic mantels and chimneys, and the stone is very handsome when so used. None of it possesses the property of iridescence in a high degree but much of it has somewhat of the character, and this enhances its effectiveness for such use.

Road metal. The best stone for roadmaking in the district is the basic variety of the syenite. This has been considerably quarried at Tupper lake and used locally upon the roads, and also been exported to some extent [pl. 18]. It is hard and tough and has excellent binding power, being equal to the best trap rock in these qualities. The more feldspathic syenite makes nearly as good road metal as the more basic variety. The more gabbroic anorthosite would also make a good road rock, though it has not been used locally because of the plentiful supply of the syenite.

Some of the roads of the quadrangle have been surfaced with sandy gravel dug from the moraine along the roadsides. Where carefully selected it makes a very good road provided its usage is not too hard. In many cases however it has not been well selected, and where there is heavy teaming it does not prove very durable.

PETROGRAPHY OF THE ROCKS

While the general petrography of many of the rocks of the quadrangle has been given by Kemp, Smyth and the writer in their various reports to the State Geologist, the work is far from being exhaustive, and some more exact work on certain rocks seemed desirable.

Grenville rocks. The quartzose rocks are the only members of the Grenville series sufficiently well shown within the quadrangle to repay careful study. In general their mineralogy is comparatively simple, as they are made up of quartz, feldspar, pyroxene and phlogopite mica in varying amounts. Small amounts of various accessory minerals are also present but seldom in sufficient quantity to affect the general statement. In general there is little difficulty in distinguishing the quartz and feldspar under the microscope, and mostly the feldspar admits of fairly accurate microscopic determination. So far as they are concerned therefore, the rocks admit of reasonably accurate microscopic analysis. But the pyroxene and mica are minerals of very varying composition, and as a first step it was desirable to have analyses of them available, for use in calculating the results of the microscopic rock analyses. For a pyroxene analysis a rock was selected free from mica, and with only accessory titanite and zircon present in addition to the quartz, feldspar and pyroxene. The titanite was fairly abundant and occurred included in all the three constituent minerals, so that it was impossible to wholly separate it from the pyroxene, but with this exception an absolutely clean pyroxene powder was obtained with Thoulet solution. Since titanites do not vary widely from their theoretical composition, it seemed that, by using the amount of TiO_2 obtained in the analysis as a base for calculating out the titanite, the remainder must closely represent the composition of the pyroxene.

Analysis of pyroxene from quartz-pyroxene gneiss (3-C-4) 1 mile east of Grampus lake

	Analysis	Titanite	Pyroxene	To 100%
SiO_2	52.87	1.43	51.44	54.20
Al_2O_3	3.01		3.01	3.17
Fe_2O_3	1.76		1.76	1.86
FeO	6.21		6.21	6.54
MgO	17.68		17.68	18.63
CaO	14.47	1.36	13.11	13.81
Na_2O	0.98		0.98	1.03
K_2O	0.29		0.29	0.31
MnO_2	0.32		0.32	0.34
H_2O	0.10		0.10	0.11
TiO_2	1.88	1.88		
	99.57	4.67	94.90	100.00

1 E. W. Morley, analyst.

Plate 17

Gate and lodge at Litchfield park, constructed of red, granitic syenite obtained near by

Plate 18

Road metal quarry in augite syenite, at Tupper Lake village. The rock is more basic and gneissoid than usual, and rather excessively jointed, those in the view belonging to the n. 50 w. series, the most prominent and regular one just here. Rude and irregular horizontal joints are also to be seen.

This pyroxene is highly exceptional in its lime-magnesia ratio, so much so that it is unsafe to assume, as was hoped might be done, that it is representative of the pyroxenes of these rocks. Since however this assumption involves less uncertainty than the assumption that some other pyroxene may be representative, or the assumption than no pyroxene is representative, it is made use of in the following calculations. It may well be that the pyroxenes formed in highly metamorphosed sediments tend to show a different lime-magnesia ratio from those of igneous rocks, in correspondence with the well known differences in this ratio exhibited by the two classes of rocks.

This especial pyroxene is of rather dark green color, as evinced also by the iron percentage shown in the analysis. But the pyroxenes of these Grenville gneisses are by no means uniform in this regard, being often white, or light green. It is however thought that this is simply due to variations of comparatively small range in the iron content, sufficiently small to form a matter of slight importance in the composition of the whole rock.

Microscopic analysis of the section of the rock by Rosiwal's method gave the result indicated in the following table. Only the

	Units measured	Sp. Gr.		Units by weight		% weight
Quartz	1506	x 2.65	=	3991	=	55.50
Feldspar	664	x 2.6	=	1726	=	24.01
Pyroxene	379	x 3.3	=	1251	=	17.40
Titanite	51	x 3.5	=	178	=	2.47
Zircon	10	x 4.5	=	45	=	0.62
Total	2610			7191		100.00

five minerals mentioned were present in the slide and the two latter in but slight quantity. The larger part of the feldspar showed plagioclase twinning with maximum extinction angles of 12°, indicating either an acid andesin, about $Ab_2\ An_1$, or else albite, in all probability the former. There was also a small amount of untwinned feldspar which was perhaps orthoclase. As a check on the calculation and an aid in making more certain the character of the feldspar, Professor Morley determined the silica and alkalis in the rock, as follows: SiO_2, 80.89%; Na_2O, 1.81%; K_2O, 0.44%.

Then the composition of the rock was calculated, first determining the pyroxene from its known composition, using the remainder of the alkalis for the orthoclase and albite determination, and the silica residue forming the quartz. The feldspar deficiency on this basis made it certain that the feldspar was not albite, hence enough

anorthite was assumed to form $Ab_2\ An_1$ with the albite. The result is given in the table, which agrees closely with the microscopic analysis, though the silica is a little higher, and the alumina correspondingly lower than in that. The more probable cause for the difference is a failure in all cases to distinguish between quartz and feldspar in the slide. But the totals would be but slightly affected, and the character of the rock as surely indicated in the one case as in the other.

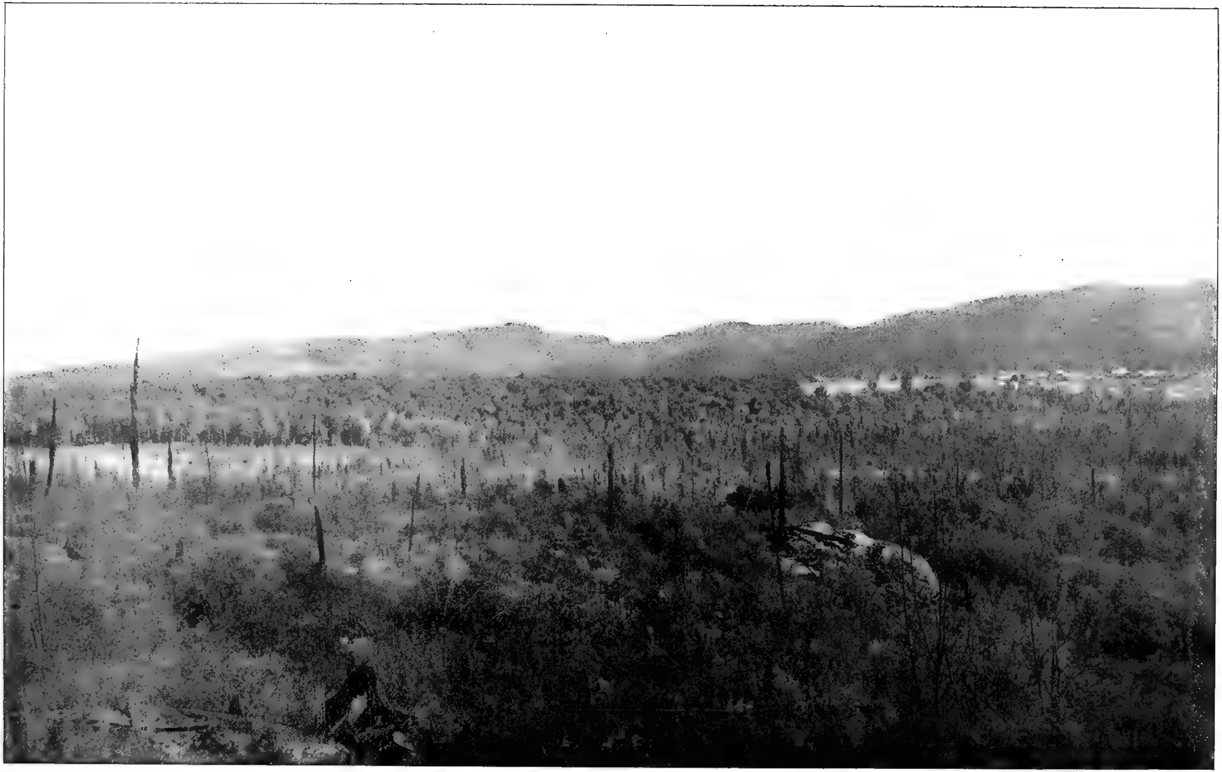
Chemical composition of quartz-pyroxene gneiss, calculated from mode and partial analysis

	Qz.	Orth.	Alb.	Anor.	Pyr.	Tit.	Zir.	Total
SiO_2	56.69	1.47	9.47	2.96	9.43	0.78	0.20	80.90
Al_2O_3	......	0.42	2.69	2.53	0.55	......	......	6.19
Fe_2O_3	......	......	......	......	0.32	......	......	0.32
FeO	......	......	......	......	1.14	......	......	1.14
MgO	......	......	......	......	3.25	......	......	3.25
CaO	......	......	......	1.38	2.41	0.69	......	4.48
Na_2O	......	......	1.63	......	0.18	......	......	1.81
K_2O	......	0.39	......	......	0.05	......	......	0.44
MnO_2	......	......	......	......	0.06	......	......	0.06
TiO_2	......	......	......	......	......	0.99	......	0.99
ZrO_2	......	......	......	......	......	......	0.42	0.42
Total	56.69	2.28	13.79	6.87	17.39	2.46	0.62	100.00

The analysis shows a distinctively sedimentary rock, a metamorphosed sandstone which was somewhat shaly, and somewhat calcareous. The low alumina, comparatively high lime and magnesia and low alkalis show a wide discrepancy when compared with any igneous rock of similar silica percentage. There is however close agreement with the composition of such a sandstone as indicated. While such origin had been inferred from the appearance of the rock in the field, and in thin section, it seems to be put beyond reasonable doubt by the analysis.

In the purer varieties of these rocks, such as are found for example on the hill in the extreme southeast corner of the quadrangle, where they are exposed in large thickness, the rock is entirely composed of quartz and white pyroxene, with here and there a little bit of graphite. The rock is foliated and the thin section is certainly richer in pyroxene than the main rock, and therefore not adapted to analysis. But the mineralogic make-up is such that there is no question as to the character of the rock. Its silica percentage would be somewhat higher than in the previous case, not far from 85%, the remainder being mostly lime and magnesia.

Plate 19



Looking southeast across the Raquette valley from a point near Tupper Lake village. On the right is the east spur of Mt Morris while in the center are seen the two great, northeasterly trending ridges which lie between Mt Morris and Follensby pond. These break down in steep cliffs at their south ends, suggesting faulting.

A slightly different, though yet more silicious rock is a quartz gneiss from the small Grenville area lying between Long lake and Pickwacket pond. It is a quartz, feldspar, phlogopite rock, with zircon as the only observed accessory mineral. The feldspar is so altered as to unfit the rock for chemical analysis, but still admits of accurate microscopic determination. Part of it is oligoclase, about $Ab_2\ An_1$, and the remainder seems orthoclase, at least it is untwinned. With no analysis of the phlogopite available it is assumed to have the composition of the phlogopite from Edwards, N. Y.[1] With these assumptions the microscopic analysis yields the following result (2-H-1).

	Units measured	Sp. Gr.		Units by weight		% weight
Quartz	2060	x 2.65	=	5459	=	79.13
Feldspar	326	x 2.64	=	861	=	12.48
Phlogopite	198	x 2.85	=	564	=	8.18
Zircon	3	x 4.5	=	14	=	0.21
Total	2587			6898		100.00

	Qz.	Alb.	Anor.	Phlog.	Zir.	Total
SiO_2	79.13	6.48	1.34	3.91	0.07	90.93
Al_2O_3	......	1.80	1.12	0.95	......	3.87
FeO	......	......	......	0.03	......	0.03
MgO	......	......	......	2.52	......	2.52
CaO	......	......	0.66	......	......	0.66
Na_2O	......	1.08	......	0.03	......	1.11
K_2O	......	......	......	0.74	......	0.74
ZrO_2	......	......	......	......	0.14	0.14
Total	79.13	9.36	3.12	8.18	0.21	100.00

It is quite possible that 20% or less of the feldspar is orthoclase, which would affect the soda-potash ratio perceptibly and the silica-alumina ratio slightly. The composition of the phlogopite may also vary somewhat from that assumed, and is likely to in the iron content more especially. While these uncertainties considerably affect the calculation when regarded as an exact rock analysis, they would affect it in such slight manner, from the standpoint of the general rock character, that it may be regarded as quite certain that we are dealing with a metamorphosed sandstone, slightly aluminous and slightly calcareous, but otherwise entirely normal.

Associated with the quartz gneisses about Lake Catlin is a much less quartzose rock which is quite micaceous. The thin section

[1] Dana. Syst. Min. Ed. 6, p. 633, no. 8.

showed it to have similar mineralogy, quartz, feldspar, pyroxene, mica, zircon, titanite, graphite and apatite being present. The pyroxene is white instead of green and probably differs considerably from that previously discussed and analyzed. The mica is unquestionable phlogopite. Some of the feldspar, about 20%, was badly altered, showed no sign of twinning, and was assumed to be orthoclase. The remainder was twinned plagioclase with 12° maximum extinction angle, and is regarded as andesin, $Ab_2 An_1$, though it is possible that it may be albite. The analysis is therefore some-

Mode of quartz-pyroxene-phlogopite gneiss (1-L-3-a)

	Units measured	Sp. Gr.		Units by weight		% weight
Quartz	699	x 2.65	=	1852	=	30.22
Feldspar	420	x 2.64	=	1109	=	18.10
Pyroxene	642	x 3.3	=	2119	=	34.56
Phlogopite	347	x 2.85	=	989	=	16.13
Titanite	10	x 3.5	=	35	=	0.57
Zircon	4	x 4.5	=	18	=	0.29
Apatite	2	x 3.2	=	6	=	0.10
Graphite	1	x 2.4	=	2	=	0.03
Total	2125			6130		100.00

Composition calculated from mode

	Qz.	Pyrox.	Phlog.	Orth.	Alb.	Anor.	Tit.	Zir. & Ap.	Total
SiO_2	30.22	18.75	7.71	2.34	6.67	2.12	0.19	0.09	68.09
Al_2O_3		1.07	1.87	0.65	1.84	1.74			7.17
Fe_2O_3		0.65							0.65
FeO		2.25	0.05						2.30
MgO		6.48	4.97						11.45
CaO		4.80				0.97	0.16	0.06	5.99
Na_2O		0.35	0.08		1.14				1.57
K_2O		0.10	1.45	0.64					2.19
MnO_2		0.11							0.11
TiO_2							0.22		0.22
ZrO_2								0.20	0.20
P_2O_5								0.03	0.03
Total	30.22	34.56	16.13	3.63	9.65	4.83	0.57	0.38	99.97

what uncertain and its result is of itself pretty good evidence that the pyroxene is of quite different character from that analyzed and used in the calculation. The lime-magnesia ratio seems clearly quite erroneous. If the lime and magnesia percentages in the pyroxene calculation are reversed, bringing it more closely into line with the composition of ordinary diopside, this anomaly disappears.

Plate 20

Looking across the main channel of the Raquette river toward Mt Seward. View taken 2 miles west of Axton, looking up one of the backset sloughs which marks the position of a former oxbow, and which is seen separated from the main channel by the log boom.

As so modified the analysis falls closely into line with the preceding, though representing a much more impure sandstone, somewhat more shaly, and much more calcareous than the more quartzose rocks. It seems quite clearly a member of the same group.

Just north of the Bog stream, near the west edge of the quadrangle, quartz, pyroxene, feldspar gneisses occur which appear less distinctly like sediments in the field, and have somewhat the look of the ordinary gneisses. But portions of the mass are excessively quartzose, and in thin section all resemble the Grenville quartzites just described. The slide of one of the more quartzose portions shows a quartz, feldspar, pyroxene rock with small amounts of titanite, magnetite, apatite and zircon. Phlogopite is lacking, and the rock is firmer, more glassy looking and less granular than the usual quartzites. The microscopic analysis however shows a close relationship.

Mode of quartzose (Grenville) gneiss (6-B-2-a)

	Units measured	Sp. Gr.		Units by weight		% weight
Quartz	2151	x 2.65	=	5700	=	65.78
Feldspar	775	x 2.65	=	2053	=	23.69
Pyroxene	230	x 3.3	=	805	=	9.29
Titanite	16	x 3.5	=	56	=	0.65
Magnetite	7	x 5.25	=	37	=	0.42
Apatite	2	x 3.2	=	6	=	0.07
Zircon	2	x 4.5	=	9	=	0.10
Total	3183			8666		100.00

Composition calculated from mode

	Qz.	Orth.	Alb.	Anor.	Pyrox.	Tit.	Mag.	Zir. & Ap.	Total
SiO_2	65.78	2.38	8.28	3.45	5.04	0.20		0.03	85.18
Al_2O_3		0.65	2.31	2.94	0.30				6.20
Fe_2O_3					0.17		0.28		0.45
FeO					0.62		0.14		0.76
MgO					1.73				1.73
CaO				1.61	1.28	0.19		0.04	3.12
Na_2O			1.41		0.09				1.50
K_2O		0.66			0.03				0.69
MnO_2					0.03				0.03
TiO_2						0.26			0.26
ZrO_2								0.07	0.07
P_2O_5								0.02	0.02
Total	65.78	3.69	12.00	8.00	9.29	0.65	0.42	0.16	100.01

As usual some uncertainties have a vitiating effect on the calculation. The pyroxene may, or may not be like the one analyzed. If not the lime-magnesia ratio would be altered, though the change would be slight. Most of the feldspar is twinned, though 15% lacks this feature. This has been calculated as orthoclase though it may not be. The remainder shows a maximum extinction of 16°. This is the angle for both albite and andesin ($Ab_3\ An_2$) but this is held with reasonable certainty to be the latter since Becke's method shows it to have the same refractive index as the quartz. Except for a possible slight increase in lime and corresponding decrease in magnesia therefore this must give a very close approximation to the actual composition of the rock. It harmonizes well with the preceding analyses and again indicates a somewhat impure sandstone, a little more aluminous and a little less calcareous than they.

Igneous rocks. *Granite.* No analyses of the Adirondack granites have been published, so far as the writer is aware. The Morris granite is of a distinct and simple type, with definitely established age relations to the other intrusives, and an accurate analysis of it seemed highly desirable. It is mainly a quartz-microperthite rock, with accessory plagioclase, hornblende (usually chloritized), magnetite, titanite and zircon, and lends itself readily to microscopic analysis. Since however the character of the feldspar can not be precisely determined microscopically an analysis was necessary to establish this. The hornblende has been thoroughly altered to

Mode of Morris granite, fine grained type (15-A-3)

	Units measured	Sp. Gr.		Units by weight		% weight
Quartz	996	x 2.65	=	2639	=	34.57
Microperthite	1804	x 2.6	=	4690	=	61.74
Plagioclase	20	x 2.63	=	153	=	2.01
Hornblende	27	x 3.2	=	86	=	1.13
Magnetite	5	x 5.25	=	26	=	0.34
Zircon	3	x 4.5	=	13	=	0.18
Titanite	1	x 3.5	=	3	=	0.03
Total	2856			7610		100.00

chlorite and small flecks of this mineral are frequent in the feldspar, and are too small to measure accurately, so that the hornblende should more properly read "chlorite" and its amount is certainly

considerably too small. The amount of zircon is probably too large, and the slide does not seem to show quite the normal amount of magnetite. The plagioclase is in minute grains and is difficult of exact determination though it seems oligoclase.

Chemical composition and norm of Morris granite (15-A-3)[1]

	Chem. comp.	Mol. ratio	Or.	Ab.	An.	Cor.	Hy.	Mt.	Qz.
SiO_2	76.41	1.273	.276	.324	.028	......	.012	......	.633
Al_2O_3	12.41	.122	.046	.054	.014	.008	......	......	......
Fe_2O_3	1.01	.006	......	......	......	......	......	.006	......
FeO	0.50	.007	......	......	......	......	.001	.006	......
MgO	0.46	.011	......	......	......	......	.011	......	......
CaO	0.78	.014	......	......	.014	......	......	......	......
Na_2O	3.34	.054	......	.054	......	......	......	......	......
K_2O	4.33	.046	.046	......	......	......	......	......	......
H_2O+	0.34	......	......	......	......	......	......	......	......
H_2O-	0.13	......	......	......	......	......	......	......	......
TiO_2	0.03	......	......	......	......	......	......	......	......
ZrO_2	0.02	......	......	......	......	......	......	......	......
F	0.01	......	......	......	......	......	......	......	......
S	0.01	......	......	......	......	......	......	......	......
MnO	0.06	......	......	......	......	......	......	......	......
Total	99.84	......	.046	.054	.014	.008	.012	.006	.633

Or.	25.58	96.34
Ab.	28.30	
An.	3.89	
Co.	0.82	
Qz	37.95	
Hy.	1.23	2.70
Mt.	1.39	
Ti.	0.08	
Rest	0.60	
Total	99.84	

Class, $\frac{\text{Sal.}}{\text{Fem.}} = \frac{96.34}{2.70} = 35.7 = 1$, persalane

Order, $\frac{Q}{F} = \frac{37.95}{57.77} = 0.65 = 3$, columbare

Rang, $\frac{Na_2O' + K_2O'}{CaO'} = \frac{100}{14} = 7.1 = 1$ alaskase

Subrang, $\frac{K_2O'}{Na_2O'} = \frac{46}{54} = .85 = 3$, alaskose

In the new classification of igneous rocks this granite would be called an alaskose. It is however very near the border between orders 3 and 4, so that a comparatively slight increase in feldspar at the expense of quartz would put it into the liparose division. The norm differs from the mode slightly in the quartz-feldspar percentages. A considerable portion of the magnetite of the norm belongs in the chlorite of the mode and with this would go the slight excess of alumina which appears as corundum in the norm. The hypersthene, corundum, and excess of magnetite of the norm

[1] E. W. Morley, analyst. P_2O_5, BaO and Cl absent.

would give an amount of chlorite considerably in excess of the chloritized hornblende of the mode, which has already been accounted for. The feldspar percentage should be correspondingly decreased. Even then the difference between the quartz feldspar ratio in the norm and mode, .65 in one case and .56 in the other, is sufficient to shift the rock into another order, .60 being the dividing ratio. The probable cause is that the ratio present in the slide is not quite normal, the quartz not being equably distributed through the rock.

Syenite. The great amount of differentiation shown by the rock of the syenite bathylith has already been noted. Analyses of a considerable number of these have been already published, but there were yet lacking those of the more basic and more acid phases, and moreover the red syenites which occur in association with the granitic syenite had not been carefully investigated.

The specimen of basic syenite (12-1-6) selected for investigation, was collected a little over a mile n.n.w. from Raquette falls. It is a rather evenly granular, gneissoid rock, feldspar phenocrysts being few and of small size. The thin section shows augite and hypersthene in the parallel growths which are so characteristic of this rock, hornblende, magnetite, light colored titanite, apatite, patchy, vermicular garnet, a little quartz, a little pyrite, and feldspar which is in part microperthite and in part oligoclase-andesin. The mode of the rock, by Rosiwal's method, is as follows:

Mode of basic syenite (12-1-6)

	Units measured	Sp. Gr.		Units by weight		% weight
Feldspar	748	x 2.64	=	1975	=	56.12
Quartz	38	x 2.65	=	101	=	2.87
Hornblende	103	x 3.3	=	340	=	9.65
Augite	123	x 3.3	=	406	=	11.54
Hypersthene	111	x 3.35	=	372	=	10.57
Magnetite	44	x 5.25	=	231	=	6.57
Garnet	7	x 3.85	=	27	=	0.77
Apatite	15	x 3.2	=	48	=	1.37
Titanite	4	x 3.5	=	14	=	0.40
Pyrite	1	x 5	=	5	=	0.14
Total	1194			3519		100.00

Chemical composition and norm of basic syenite (12-1-6)[1]

	Chem. comp.	Mol. ratio.	Or.	Ab.	An.	Di.	Hy.	Mag.	Ap.	Ti.	Qz.	Py.
SiO_2	54.10	.902	.196	.368	.154	.026	.107	....	....	.002	.048	....
Al_2O_3	17.45	.171	.033	.061	.077	....	....	....	....	....	....	....
Fe_2O_3	4.52	.028	....	....	....	....	....	.028	....	....	....	.002
FeO	6.47	.090	....	....	....	.007	.050	.028	....	.002	....	....
MgO	2.33	.058	....	....	....	.006	.052	....	....	....	....	....
CaO	6.17	.110	....	....	.076	.013	....	....	.021	....	....	....
Na_2O	3.81	.061	....	.061	....	....	....	....	....	....	....	....
K_2O	3.06	.033	.033	....	....	....	....	....	....	....	....	....
H_2O+	0.48	....	....	....	....	....	....	....	....	....	....	....
$H_2O—$	0.09	....	....	....	....	....	....	....	....	....	....	....
TiO_2	0.19	.002	....	....	....	....	....	....	....	.002	....	....
P_2O_5	0.88	.006	....	....	....	....	....	....	.006	....	....	....
F	0.05	.003	....	....	....	....	....	....	.003	....	....	....
S	0.14	.004	....	....	....	....	....	....	....	....	....	.004
MnO	0.35	.005	....	....	....	....	.005	....	....	....	....	....
BaO	0.10	.001	....	....	.001	....	....	....	....	....	....	....
Total	100.19	....	.033	.061	.077	.026	.107	.028	.006	.002	.048	.002
	.06											
	100.13		ZrO₂, Cr₂O₃ and Cl absent									

Or.	18.13	74.59
Ab.	32.17	
An.	21.43	
Qz.	2.86	
Di.	3.05	24.83
Hy.	12.50	
Mt.	6.57	
Ti.	0.36	
Ap.	2.09	
Py.	0.26	
Total.	99.42	

Class, $\frac{\text{Sal.}}{\text{Fem.}} = \frac{74.59}{24.83} = 3.00 = \text{II} = $ dosalane

Order, $\frac{Q}{F}\frac{2.86}{71.73} = .04 = 5$, germanare

Rang, $\frac{Na_2O' + K_2O'}{CaO'} = \frac{940}{1102} = .85 = 3$. andase

Subrang, $\frac{K_2O}{Na_2O}\frac{32}{61} = .53 = 4$, andose, but near shoshonose

As usual with these rocks the ferrous iron determination was unsatisfactory from some cause not yet clear, the result of the analysis showing 10.96 FeO out of a total iron of 10.99. In this case there is a possibility that the pyrite may be accountable for the discrepancy, but it is very unlikely that this is the case since the trouble is constant in the rock group and the pyrite is occasional. The microscopic analysis showed a considerable percentage of magnetite present, the amount of which was checked by separating the magnetite from a certain portion of the rock, so that the result

[1] Sp. Gr. 2.964 at 18°. Analyst, E. W. Morley.

is reasonably accurate. The ferric iron given in the analysis is that in the magnetite as thus determined. It is certainly somewhat low since there is a strong probability of some ferric iron in the femic minerals but there is an equally strong probability that the amount is trifling, so that reasonable confidence is felt that the figures given are close to the truth.

Since the same error in the iron determination is found in the syenite analyses previously published, and since it is also desirable to consider them with respect to their position in the new rock classification, microscopic analyses were also made of them and the figures for iron changed so far as determinations of the amount of magnetite present would permit. As thus modified the analyses should supersede those already published [N. Y. State Mus. Bul. 95. p. 331–32].

	1	2	3	4	5	6	7	8
SiO_2	54.10	57.00	59.70	61.01	63.45	65.65	66.72	68.5
Al_2O_3	17.45	16.01	19.52	15.36	18.38	16.84	16.15	14.69
Fe_2O_3	4.52	10.30	1.89	2.98	1.09	4.01	1.23	1.34
FeO	6.47		4.92	7.77	2.69		2.19	3.25
MgO	2.33	1.62	.78	.78	.35	.13	.73	.26
CaO	6.17	6.20	3.36	4.05	3.06	2.47	2.30	2.20
Na_2O	3.81	4.35	5.31	3.68	5.06	5.27	4.36	3.50
K_2O	3.06	3.53	4.14	3.90	5.15	5.04	5.66	5.90
H_2O+	0.48	.15						
H_2O-	0.09		.52	.49	.30	.30	.77	.40
TiO_2	0.19				.07			
P_2O_5	0.88							.03
Cl								
F	0.05							
S	0.14							
MnO	0.35		.09	.08	trace		.07	.10
BaO	0.10				.13			.05
Total	100.19	99.16	100.23	100.10	99.73	99.71	100.18	100.22
	.06							
	100.13							
Sp. gr.	2.964		2.674		2.719			

1 Basic syenite (andose) from near Raquette falls, analysis by E. W. Morley.

2 Basic syenite from Natural Bridge, Diana, Lewis co. C. H. Smyth jr, Geol. Soc. Am. Bul. 6:274.

3 Augite syenite (laurvikose), road from Tupper lake to Wawbeek, N. Y. State Geol. 20th An. Rep't. 1902. p. r69.

4 Augite syenite (harzose), by N. Y. C. & H. R. Railroad. $3\frac{1}{2}$ miles north of Tupper Lake Junction. *Op. cit.* p. r69.

5 Augite syenite (pulaskose), Loon lake, Franklin co. Geol. Soc. Am. Bul. 10:177–92.

6 Augite syenite, near Harrisville, Diana, Lewis co. C. H. Smyth jr, Geol. Soc. Am. Bul. 6:271–74.

7 Augite syenite (toscanose), Little Falls, Herkimer co. *Op. cit.* p. r69.

8 Quartz syenite (toscanose), N. Y. & Ottawa Railroad. $2\frac{1}{2}$ miles south of Willis pond, Altamont, Franklin co. *Op. cit.* p. r69.

All analyses except 2 and 6 by E. W. Morley.

This series of analyses gives an excellent representation of the amount of differentiation in the Tupper syenite bathylith. To be sure analyses 2, 5, 6 and 7 are from rocks from other localities, but 5, 6 and 7 are representative of the normal character of the rock at all localities, at Tupper lake as well as at other points, and 2 is a distinct intermediate stage between 1 and 3 which could certainly be duplicated there. These are all green syenites; analyses of the red syenites will follow. Only analyses of the red granitic phases fail.

Of the six analyses which are sufficiently complete to enable the placing of the rock in the new system, it will be seen that four are persalanes and two dosalanes, that five different orders are represented and five different subrangs, altogether showing a large amount of differentiation for a bathylith of no great size. While it is possible that somewhat more acid phases may be present it is held to be very unlikely that any of the rocks of the bathylith run over 70% of silica.

It is to be noted that all of the rock has experienced considerable metamorphism, having a granular structure which has been produced by mashing and recrystallization, and that the original structure was granitic and somewhat porphyritic. The rock of analysis 1 would therefore be properly described as a hornblendic pyroxene-granophyro-andose.

The rock of analysis 3 is from a large dike of syenite which cuts gabbroid anorthosite. It is a granular, quite porphyritic rock composed of microperthite, augite, hornblende, garnet, magnetite and quartz, the garnet and quartz mainly in corrosion rims between the magnetite and feldspar. Its norm is as follows:

Chemical composition and norm of hornblendic augite-laurvikose

	Chem. comp.	Mol. ratio	Or.	Ab.	An.	Co.	Hy.	Mt.	Qz.
SiO_2	59.70	.995	.263	.514	.123	......	.076	......	.019
Al_2O_3	19.52	.191	.044	.086	.061	.0004	......	......	......
Fe_2O_3	1.89	.012	......	......	......	......	......	.012	......
FeO	4.92	.068	......	......	......	......	.057	.012	......
MgO	.78	.019	......	......	......	......	.019	......	......
CaO	3.36	.060	......	......	.060	......	......	......	......
Na_2O	5.31	.086	......	.086	......	......	......	......	......
K_2O	4.14	.044	.044	......	......	......	......	......	......
H_2O	0.52	......	......	......	......	......	......	......	......
MnO	0.09	.001	......	......	.001	......	......	......	......
Total ..	100.23	......	.044	.086	.061	......	.076	.012	.019

$$\left.\begin{array}{ll}\text{Or.....} & 24.40\\ \text{Ab....} & 44.85\\ \text{An....} & 17.04\\ \text{Co.....} & 0.04\\ \text{Qz....} & 1.16\end{array}\right\}\ 87.49$$

$$\left.\begin{array}{ll}\text{Mt....} & 2.73\\ \text{Hy....} & 9.40\end{array}\right\}\ 12.13$$

Total 99.62

Class, $\frac{\text{Sal.}}{\text{Fem.}} = \frac{87.49}{12.13} = 7.21 = 1$, persalane

Order, $\frac{Q}{F} = \frac{1.16}{86.33} = .013 = 5$, canadare

Rang, $\frac{K_2O' + Na_2O'}{CaO'} = \frac{1295}{613} = 2.1 = 2$, pulaskase

Subrang, $\frac{K_2O'}{Na_2O'} = \frac{44}{86} = .51 = 4$, laurvikose

The rock is close to the border between classes I and II, and also between subrangs 3 and 4, so that it is near both pulaskose and akerose, more especially the latter.

The rock of analysis 4 has the following mode

	Units measured Sp. Gr.		Units by weight		% weight
Microperthite	1546 x 2.6	=	4011	=	58.07
Plagioclase	159 x 2.63	=	417	=	6.04
Quartz	247 x 2.65	=	654	=	9.47
Augite	143 x 3.3	=	472	=	6.83
Bronzite	63 x 3.3	=	208	=	3.01
Hornblende	127 x 3.2	=	406	=	6.01
Garnet	84 x 3.7	=	311	=	4.50
Magnetite	57 x 5.25	=	299	=	4.33
Apatite	22 x 3.2	=	70	=	1.01
Titanite	6 x 3.5	=	21	=	0.33
Pyrite	6 x 5.0	=	30	=	0.43
Zircon	2 x 4.5	=	9	=	0.13
Total	2462		6908		100.16

Also biotite and allanite 1 each.

Though slightly more acid than the previous rock it has a much larger percentage of femic and alferric minerals. It is also noteworthy in the number of different minerals shown in the slide, 14 being present. The magnetite would yield 2.98% of Fe_2O_3, and this is substituted for the small amount which the chemical analysis yielded.

Norm of hornblendic pyroxene-harzose (analysis 4)

	Chem. comp.	Mol. ratio	Or.	Ab.	An.	Hy.	Di.	Mt.	Ti.	Qz.
SiO_2	61.01	1.017	.248	.356	.100	.087	.043	....	.001	.181
Al_2O_3	15.36	.151	.041	.059	.050	....	....	....	....	....
Fe_2O_3	2.98	.019	....	....	....	....	....	.019	....	....
FeO	7.77	.108	....	....	....	.072	.017	.019	....	....
MgO	.78	.019	....	....	....	.015	.004	....	....	....
CaO	4.05	.072	....	....	.050	....	.021	....	.001	....
Na_2O	3.68	.059	....	.059	....	....	....	....	....	....
K_2O	3.90	.041	.041	....	....	....	....	....	....	....
H_2O	0.49	......	....	....	....	....	....	....	....	....
MnO	0.08	.001	....	....	....	....	.001	....	....	....
Total	100.10	......	.041	.059	.050	.087	.043	.019	.001	.181

Or.	23.02	78.90
Ab.	31.13	
An.	13.89	
Qz.	10.86	
Mt.	4.32	20.74
Hy.	11.03	
Di.	5.22	
Ti.	0.17	
Total	99.64	

Class, $\frac{\text{Sal.}}{\text{Fem.}} = \frac{78.90}{20.74} = 3.81 = \text{I}$, dosalane

Order, $\frac{\text{Q}}{\text{F}} = \frac{10.86}{68.04} = 0.16 = 4$, austrare

Rang, $\frac{K_2O' + Na_2O'}{CaO'} = \frac{100}{72} = 1.4 = 3$, tonalase

Subrang, $\frac{K_2O'}{Na_2O'} = \frac{41}{59} = .7 = 3$, harzose

The rock is close to the division line between orders 4 and 5, so that it is a harzose very close to shoshonose.

The slides of the type syenite from Loon lake, analysis 5, have been mislaid and could not be found, so that the readjustment of the iron percentages had to be based wholly on separation of magnetite from a weighed amount of crushed rock by heavy solutions and magnet. The result gave 1.58% of magnetite, or 1.09% of Fe_2O_3, which is certainly much more nearly correct than the .42% of the original analysis. Its norm would thus become:

Or.....	30.41	91.42	Class, $\frac{\text{Sal.}}{\text{Fem.}} = \frac{91.42}{7.94} = 11.5 = 1$, persalane
Al.....	42.76		Order, $\frac{Q}{F} = \frac{6.05}{85.37} = .07 = 5$, canadare
An....	12.20		
Qz.....	6.05		
Mt....	1.58	7.94	Rang, $\frac{K_2O' + Na_2O'}{CaO'} = \frac{136}{52} = 2.6 = 2$, pulaskase
Di.....	2.00		Subrang, $\frac{K_2O'}{Na_2O'} = \frac{55}{81} = .68 = 3$, pulaskose
Hy....	4.19		
Ti.....	0.17		
Total	99.36		

The rock falls close to the boundary between subrangs 3 and 4, or is close to laurvikose, showing thus its close relationship with the considerably more basic rock of analysis 3.

The Little Falls rock (analysis 7) has beautiful cataclastic structure with the production of much finely granular feldspar and quartz which can not with certainty be distinguished in the thin section. The quartz and feldspar had therefore to be measured together in the determination of the mode.

Mode of Little Falls syenite (toscanose) analysis 7

	Units measured	Sp. Gr.		Units by weight		% weight
Quartz and feldspar..............	2852	x 2.61	=	7444	=	87.28
Hornblende....................	189	x 3.2	=	604	=	7.08
Pyroxene......................	50	x 3.3	=	165	=	1.94
Magnetite.....................	30	x 5.25	=	158	=	1.85
Biotite.......................	20	x 3.	=	60	=	0.70
Apatite.......................	10	x 3.2	=	32	=	0.37
Titanite......................	11	x 3.5	=	38	=	0.44
Zircon........................	3	x 4.5	=	13	=	0.14
Pyrite........................	3	x 5.	=	15	=	0.18
Total.........................	3168			8529		99.98

Norm of Little Falls syenite

Or.....	33.42	91.51	Class, $\frac{\text{Sal.}}{\text{Fem.}} = \frac{91.51}{8.04} = 11.37 = 1$, persalane
Ab....	36.84		Order, $\frac{Q}{F} = \frac{13.47}{78.04} = .17 = 4$, britannare
An....	7.78		
Qz.....	13.47		
Mt....	1.85	8.04	Rang, $\frac{K_2O' + Na_2O'}{CaO'} = \frac{136}{52} = 2.6 = 2$, toscanase
Di.....	2.23		Subrang, $\frac{K_2O'}{Na_2O'} = \frac{547}{816} = .67 = 3$, toscanose
Hy....	3.59		
Ap....	0.37		
Total	99.55		

The quartz-feldspar ratio is nearly low enough to throw the rock into order 5 instead of 4, so that it is a toscanose close to pulaskose.

The mode of the rock of analysis 8 showed 1.86% of Fe_2O_3, and the original analysis was corrected on this basis, so far as the iron values are concerned. The norm, and position of the rock in the new classification are as follows:

Norm of pyroxenic hornblende-toscanose (analysis 8)

	Chem. comp.	Mol. ratio.	Or.	Ab.	An.	Di.	Hy.	Mt.	Ap.	Qz.
SiO_2	68.50	1.142	.376	.339	.050	.028	.031			.318
Al_2O_3	14.60	.144	.063	.056	.025					
Fe_2O_3	1.34	.008						.008		
FeO	3.25	.045				.012	.025	.008		
MgO	0.26	.007				.002	.005			
CaO	2.20	.039			.025	.014			.0007	
Na_2O	3.50	.056		.056						
K_2O	5.90	.063	.063							
H_2O	0.40									
P_2O_5	0.03	.0002							.0002	
MnO	0.10	.001					.001			
BaO	0.05									
Total	100.22		.063	.056	.025	.028	.031	.008		.318

Or.	34.81	90.43
Ab.	29.61	
An.	6.92	
Qz.	19.09	
Hy.	3.95	9.29
Di.	3.41	
Ap.	0.07	
Mt.	1.86	
Total	99.72	

Class, $\frac{\text{Sal.}}{\text{Fem.}} = \frac{90.43}{9.29} = 9.8 = 1$, persalane

Order, $\frac{Q}{F} = \frac{19.09}{71.34} = .27 = 4$, britannare

Rang, $\frac{K_2O' + Na_2O'}{CaO'} = \frac{119}{39} = 3.1 = 2$, toscanase

Subrang, $\frac{K_2O'}{Na_2O'} = \frac{63}{56} = 1.13 = 3$, toscanose

Because of its greater acidity this rock is a fairly normal toscanose, instead of being on the pulaskose border, the quartz being to the feldspar as 1 : 4 instead of 1 : 6 as in the previous case.

Red syenites. It has been shown that on the southern margin of the Tupper syenite a considerable mass of red syenites and granitic syenites occurs, showing apparent gradations into the normal syenite, though it is not yet definitely established whether it is a differentiate from that or a separate intrusion. The rock is usually evenly granular and gneissoid, though often showing small, porphyritic feldspars, but it runs into coarsely porphyritic varieties. The tendency of the quartz to assume the leaf, or spindle types is even more pronounced than in the green syenite. The analyses

show very little difference in composition between the two. Hornblende is more prominent than pyroxene in the red rock while the reverse is true in the green. Only one analysis has been made of the red rocks, but the rock lends itself readily to microscopic analysis and these have been used to supplement the other. As a test of the matter a microscopic analysis of the rock later analyzed was made and calculated. The feldspars are easily distinguished from the quartz, and judging from those in the other syenites were assumed to consist of orthoclase and plagioclase in the ratio 3 : 4, and the plagioclase was assumed to be $Ab_4 An_1$. The hornblende was assumed to have the composition of the hornblende from the quartz-monzonite from Mt Hoffman, Cal.[1]

Mode of red syenite (granophyro-hornblende monzonose) from the north boundary of Litchfield park (10-B-2)

	Units measured	Sp. Gr.		Units by weight		% weight
Microperthite	793	x 2.6	=	2062	=	54.65
Plagioclase	320	x 2.6	=	832	=	22.02
Quartz	146	x 2.65	=	387	=	10.24
Hornblende	117	x 3.3	=	386	=	10.22
Magnetite	15	x 5.2	=	78	=	2.07
Apatite	7	x 3.2	=	22	=	0.58
Zircon	2	x 4.3	=	9	=	0.22
Total	1400			3776		100.00

Composition calculated from mode

	Qz.	Orth.	Alb.	Anor.	Horn.	Mag.	Apat.	Zirc.	Total
SiO_2	10.24	21.27	24.17	3.79	5.05	......	......	0.07	64.59
Al_2O_3	......	6.01	6.79	3.26	0.75	......	......	......	16.81
Fe_2O_3	......	......	......	......	0.51	1.43	......	......	1.94
FeO	......	......	......	......	1.12	0.64	......	......	1.76
MgO	......	......	......	......	1.39	......	......	......	1.39
CaO	......	......	......	1.78	1.27	......	0.32	......	3.37
Na_2O	......	......	4.14	......	0.08	......	......	......	4.22
K_2O	......	5.51	......	......	0.05	......	......	......	5.56
P_2O_5	......	......	......	......	......	......	0.24	......	0.24
F	......	......	......	......	......	......	0.02	......	0.02
ZrO_2	......	......	......	......	......	......	......	0.15	0.15
Total	10.24	32.79	35.10	8.83	10.22	2.07	0.58	0.22	100.05

1 U. S. Geol. Sur. Bul. 168, p. 208.

Analysis and norm of red syenite (monzonose), 10-B-2[1]

	Chem. comp.	Mol. ratio.	Or.	Ab.	An.	Di.	Hy.	Mt.	Ti.	Ap.	Qz.
SiO_2	62.85	1.047	.350	.396	.081	.028	.048	....	.001	....	.143
Al_2O_3	16.80	.165	.058	.066	.040	....	....	....	....	....	....
Fe_2O_3	2.96	.018	....	....	....	....	....	.018	....	....	....
FeO	2.89	.040	....	....	....	.006	.016	.018	....	....	....
MgO	1.48	.037	....	....	....	.008	.029	....	....	....	....
CaO	3.24	.058	....	....	.040	.014	....	....	.001	.003	....
Na_2O	4.09	.066	....	.066	....	....	....	....	....	....	....
K_2O	5.49	.058	.058	....	....	....	....	....	....	....	....
H_2O+	0.24	....	....	....	....	....	....	....	....	....	....
H_2O-	0.13	....	....	....	....	....	....	....	....	....	....
TiO_2	0.09	.001	....	....	....	....	....	....	.001	....	....
P_2O_5	0.13	.001	....	....	....	....	....	....	....	.001	....
F	0.01	....	....	....	....	....	....	....	....	....	....
S	0.02	....	....	....	....	....	....	....	....	....	....
MnO	0.21	.003	....	....	....	....	.003	....	....	....	....
BaO	0.06	....	....	....	....	....	....	....	....	....	....
Total	100.69	....	.058	.066	.040	.028	.048	.018	.001	.001	.143

Or	32.47	86.87
Ab	34.58	
An	11.20	
Qz	8.62	
Di	3.19	13.43
Hy	5.42	
Mt	4.29	
Ap	0.31	
Ti	0.22	
Total	100.30	

Class, $\frac{\text{Sal.}}{\text{Fem.}} = \frac{86.87}{13.43} = 6.47 = \text{II}$, dosalane

Order, $\frac{Q}{F} = \frac{8.62}{78.25} = .11 = 5$, germanare

Rang, $\frac{K_2O' + Na_2O'}{CaO'} = \frac{124}{58} = 2.1 = 2$, monzonase

Subrang, $\frac{K\,O'}{Na_2O'} = \frac{59}{66} = .9 = 3$, monzonose

On the border between classes I and II, hence close to pulaskose.

A comparison of the two analyses shows a reasonably close agreement in all respects, and indicates that microscopic analysis furnishes a means of quite accurate determination of the composition of these rocks. It shows that the feldspars have closely the assumed composition, and that the hornblende is probably lower in silica and higher in iron than the Californian hornblende used in the calculation. The norm calculated from the result of the microscopic analysis would closely agree with the other, and serve equally for classifying the rock.

A comparison of the analysis with those of the green syenites shows a close agreement, the main differences being the different ratio between the iron oxids and the lower magnesia of the green

[1] Sp. Gr. 2.735 at 18°. E. W. Morley, analyst.

rocks. The field evidence of close relationship between the rocks thus receives forcible corroboration.

One half mile east of the locality from which the previous rock was obtained, on the north line of Litchfield park, occurs a beautiful, coarse red syenite which differs from the last in holding little or no quartz. Its calculation follows:

Mode of red syenite (monzonose) 10-C-1

	Units measured	Sp. Gr.		Units by weight		% weight
Microperthite	1463	x 2.6	=	3803	=	65.72
Plagioclase	299	x 2.63	=	786	=	13.58
Hornblende	267	x 3.2	=	854	=	14.76
Quartz	62	x 2.65	=	164	=	2.84
Magnetite	32	x 5.25	=	168	=	2.90
Apatite	1	x 3.2	=	3	=	0.05
Zircon	2	x 4.3	=	9	=	0.15
Total	2126			5787		100.00

Composition and norm calculated from mode

	Qz.	Orth.	Alb.	Anor.	Horn.	Mag.	Apat.	Zirc.	Total
SiO_2	2.84	22.03	24.90	3.91	7.29			0.05	61.02
Al_2O_3		6.24	7.06	3.33	1.08				17.71
Fe_2O_3					0.75	2.00			2.75
FeO					1.64	0.90			2.54
MgO					2.01				2.01
CaO				1.82	1.83		0.03		3.68
Na_2O			4.29		0.11				4.40
K_2O		5.72			0.05				5.77
P_2O_5							0.02		0.02
ZrO_2								0.10	0.10
Total	2.84	33.99	36.25	9.06	14.76	2.90	0.05	0.15	100.00

The calculated norm is:

Or.	Ab.	An.	Di.	Hy.	Mt.	Qz.
34.15	37.20	11.40	5.53	4.74	3.99	2.82

$$\text{Class, } \frac{\text{Sal.}}{\text{Fem.}} = \frac{85.57}{14.26} = 6.0 = \text{II, dosalane}$$

$$\text{Order, } \frac{Q}{F} = \frac{2.82}{82.75} = .034 = 5, \text{ germanare}$$

$$\text{Rang, } \frac{K_2O' + Na_2O'}{CaO'} = \frac{132}{66} = 2, \text{ monzonase}$$

$$\text{Subrang, } \frac{K_2O'}{Na_2O'} = \frac{61}{71} = .86 = 3, \text{ monzonose}$$

Judging by the previous case the silica and iron are a trifle out of the way, the former too high and the latter too low. It might be legitimate to modify the analysis proportionately with the differ-

ences shown in the two analyses of the previous rock, but these would affect it but slightly, and since the trouble with the previous analysis may be mainly owing to the fact that the normal amount of magnetite did not get into the slide, rather than because of difference in the composition of the hornblende, the change might not be an improvement. The analysis is confidently regarded as an accurate expression of the composition of the rock, which is somewhat more basic than the previous one.

As a sample of the more granitic syenite of this group a rock was selected which outcrops on the road from the Litchfield gate to the boathouse on Tupper lake. It is quite similar to the rock of which the lodge and gate are built and it outcrops over a wide area within the park where it seems to shade into the green syenite. While some portions of the mass may be even more acid than this is, none is greatly more so.

Mode of red, granitic syenite (toscanose), 869

	Units measured	Sp. Gr.		Units by weight		% weight
Microperthite	1907	x 2.6	=	4958	=	67.20
Plagioclase	281	x 2.63	=	739	=	10.01
Quartz	452	x 2.65	=	1198	=	16.24
Hornblende	107	x 3.2	=	342	=	4.63
Magnetite	21	x 5.25	=	110	=	1.49
Biotite	3	x 3.0	=	9	=	0.12
Apatite	6	x 3.2	=	19	=	0.25
Zircon	1	x 4.5	=	4	=	0.05
Total	2778			7379		99.99

Composition and norm calculated from mode

	Qz.	Orth.	Alb.	Anor.	Horn.	Biot.	Mag.	Apat.	Zir.	Total
SiO_2	16.24	21.47	24.26	3.82	2.29	0.05			0.02	68.15
Al_2O_3		6.06	6.86	3.25	0.34	0.02				16.53
Fe_2O_3					0.23	0.01	1.02			1.26
FeO					0.51	0.02	0.47			1.00
MgO					0.63	0.01				0.64
CaO				1.78	0.57			0.13		2.48
Na_2O			4.18		0.04					4.22
K_2O		5.56			0.02	0.01				5.59
P_2O_5								0.10		0.10
F								0.02		0.02
ZrO_2									0.03	0.03
Total	16.24	33.09	35.30	8.85	4.63	0.12	1.49	0.25	0.05	100.02

From which the norm is:

Or.	Ab.	An.	Mt.	Di.	Hy.	Qz.	Total
33.08	35.32	9.79	1.84	2.03	1.40	16.36	99.82

Class, $\frac{\text{Sal.}}{\text{Fem.}} = \frac{94.55}{5.27} = 18 = 1$, persalane

Order, $\frac{Q}{F} = \frac{16.36}{78.19} = .21 = 4$, britannare

Rang, $\frac{K_2O' + Na_2O'}{CaO'} = \frac{127}{44} = 2.9 = 2$, toscanase

Subrang, $\frac{K_2O'}{Na_2O'} = \frac{59}{67} = .88 = 3$, toscanose

A coarse, red, porphyritic syenite which is very quartzose, composes the steep cliffs on the south end of the big ridge known locally as Follensby mountain, which lies southwest of Follensby pond. Its mineralogy is the same as the previous rocks except for holding augite in addition to hornblende. In the calculation the augite was assumed to have the composition of the diopside from the laurvikite near Laurvik, Norway.[1] While that is more basic it is otherwise a similar rock to this, and the augite has the same character as that in the more basic syenites which closely correspond to Brögger's rock. For the sake of brevity the details of the calculation are omitted.

Mode, composition and norm of toscanose (10-D-3)

Units measured		% weight	Composition		Norm	
Microperthite	1760	59.50	SiO_2	74.17	Or	26.80
Quartz	898	30.93	Al_2O_3	13.30	Ab	28.98
Plagioclase	72	2.47	Fe_2O_3	0.26	An	7.48
Hornblende	96	4.12	FeO	0.77	Di	3.27
Augite	67	2.87	MgO	0.81	Hy	1.68
Magnetite	1	0.07	CaO	2.34	Mt	0.37
Apatite	1	0.04	Na_2O	3.43	Qz	31.64
			K_2O	4.53		
			P_2O_5	0.02		
Total	2895	100.00		99.63		100.22

Class, $\frac{\text{Sal.}}{\text{Fem.}} = \frac{95.90}{5.22} = 19 = 1$, persalane

Order, $\frac{Q}{F} = \frac{31.64}{63.26} = .5 = 4$, britannare

Rang, $\frac{K_2O' + Na_2O'}{CaO'} = \frac{103}{42} = 2.4 = 2$, toscanase

Subrang, $\frac{K_2O'}{Na_2O'} = \frac{48}{55} = .87 = 3$, toscanose

1 Brögger, Eruptivgest. Kristianageb. 3:23.

This is the most acid of any rock yet analyzed occurring as a part of the general syenite mass and is an unquestionable granite. It is quite close to order 3, and though not quite so acid much resembles the Morris granite in composition, except for the higher lime. For convenience in comparison the four analyses, and that of the Morris granite are here placed side by side.

	I	II	III	IV	V
SiO_2	61.02	62.85	68.15	74.17	76.41
Al_2O_3	17.71	16.80	16.53	13.30	12.41
Fe_2O_3	2.75	2.96	1.26	0.26	1.01
FeO	2.54	2.89	1.00	0.77	0.50
MgO	2.01	1.48	0.64	0.81	0.46
CaO	3.68	3.24	2.48	2.34	0.78
Na_2O	4.40	4.09	4.22	3.43	3.34
K_2O	5.77	5.49	5.59	4.53	4.33
H_2O+	......	0.24	......	......	0.34
H_2O-	......	0.13	......	......	0.13
TiO_2	......	0.09	......	......	0.03
P_2O_5	0.02	0.13	0.10	0.02	trace
F	......	0.01	0.02	......	0.01
S	......	0.02	......	......	0.01
ZrO_2	0.10	trace	0.03	......	0.02
MnO	......	0.21	......	......	0.06
BaO	......	0.06	......	......	trace
Total	100.00	100.69	100.02	99.63	99.84

I Syenite, (monzonose) 10-C-1, microscopic analysis.
II Syenite, (monzonose) 10-B-2, E. W. Morley, analyst.
III Quartz syenite (toscanose) 869, microscopic analysis.
IV Granite (toscanose) 10-D-3, microscopic analysis.
V Morris granite (alaskose) 15-A-3, E. W. Morley, analyst.

Grenville igneous rocks. There occurs in frequent association with the Grenville sediments of the quadrangle, especially with the quartz gneisses, a rock which is not especially gneissoid, has an igneous look, and also at times appears to show igneous contacts against the quartz schists, though these are so disturbed that it is difficult to be certain in the matter. The texture is fine grained granitic, with abundant glittering feldspar cleavages, and the color is a grayish white, with a smack of a flesh-colored tinge. It is a fairly easy rock to recognize, though difficult to describe with exactness. If an igneous rock it is certainly of much greater antiquity than the big intrusions, and to class it with the Grenville, with which alone it occurs, seems the obvious course. Its chemical composition is as follows:

Composition and norm of Grenville quartz-syenite (dellenose) I-M-5 from near Lake Catlin

	Chem. comp.	Mol. ratio.	Or.	Ab.	An.	Di.	Wo.	Mt.	Ti.	Py.	Qz.
SiO_2	68.66	.144	.479	.199	.028	.041	.009	....	.002	....	.386
Al_2O_3	12.98	.127	80	33	14	....	....	....	....	....	....
Fe_2O_3	2.89	.018	....	....	....	....	....	18	....	....	....
FeO	1.26	.018	....	....	....	....	....	17	....	1	....
MgO	0.76	.019	....	....	....	19	....	....	....	....	....
CaO	2.63	.047	....	....	14	21	9	....	2	....	....
Na_2O	2.05	.033	....	33	....	....	....	....	....	....	....
K_2O	7.50	.080	80	....	....	....	....	....	....	....	....
H_2O+	0.48	......	....	....	....	....	....	....	....	....	....
H_2O-	0.09	......	....	....	....	....	....	....	....	....	....
TiO_2	0.19	.002	....	....	....	....	....	....	2	....	....
P_2O_5	0.07	.0005	....	....	....	....	....	....	....	....	....
F	0.01	......	....	....	....	....	....	....	....	....	....
S	0.08	.002	....	....	....	....	....	....	....	2	....
MnO	0.24	.003	....	....	....	2	....	1	....	....	....
BaO	0.07	......	....	....	....	....	....	....	....	....	....
Total	99.96	......	.080	.033	.014	.041	.009	.018	.002	....	.386

Or.	44.37	88.86
Ab.	17.34	
An.	3.97	
Qz.	23.18	
Di.	4.50	10.39
Wol.	1.06	
Mt.	4.20	
Ti.	0.33	
Py.	0.15	
Ap.	0.15	
Total	99.25	

Class, $\frac{\text{Sal.}}{\text{Fem.}} = \frac{88.86}{10.39} = 8.5 = 1$, persalane

Order, $\frac{Q}{F} = \frac{23.18}{65.68} = .35 = 4$, britannare

Rang, $\frac{K_2O' + Na_2O'}{CaO'} = \frac{113}{47} = 2.4 = 2$, toscanase

Subrang, $\frac{K_2O'}{Na_2O'} = \frac{80}{33} = 2.4 = 2$, dellenose

E. W. Morley, analyst.

Chemically this rock is sharply distinguished from the syenites by the somewhat lower alumina and soda, and the high potash. The slide shows the feldspar to be mainly microcline, though with some microcline-microperthite and microperthite. It shows considerable quartz though by no means so much as the analysis indicates, and the dark colored minerals are augite and titanite, very little magnetite being present. The augite must therefore be high in iron. The character of the feldspar is quite different from that of the syenites, as indeed might be expected from the analysis, and this constitutes the main difference between this rock and the syenites. The augite must also be of quite different composition.

The analysis seems to warrant the conclusion that the rock is an igneous one, and if that be true the obvious differences between it and the eruptives previously described suggest a separation from them and likely an age difference.

Pyroxenic amphibolites, hornblende-andesin rocks with accessory augite, hypersthene and magnetite, occur in abundance associated with the distinctive Grenville rocks and have been described by all workers in districts where these rocks occur. They have been sometimes regarded as sediments, and sometimes as igneous rocks. The appended analysis is therefore of interest. It is the average of the three best analyses turned in by a class in quantitative analysis, and is therefore not of high grade. In consideration of the close supervision however, the close agreement between the three, and the general high character of the work done by the three men, it is thought to be worthy of respect, in consideration of the lack of better analyses. The rock was a Grenville amphibolite occurring south of Follensby pond and not far north of Moose creek.

SiO_2	50.71
Al_2O_3	18.75
Fe_2O_3	7.85
MgO	3.78
CaO	9.78
Na_2O	4.86
K_2O	2.42
H_2O+	1.13
H_2O-	0.06
MnO	0.25
Total	99.59

This is the composition of a diorite, or gabbro, and suggests, though it does not demonstrate, the igneous nature of the rock. If it be igneous it likewise is probably a much more ancient rock than the gabbros of the intrusions.

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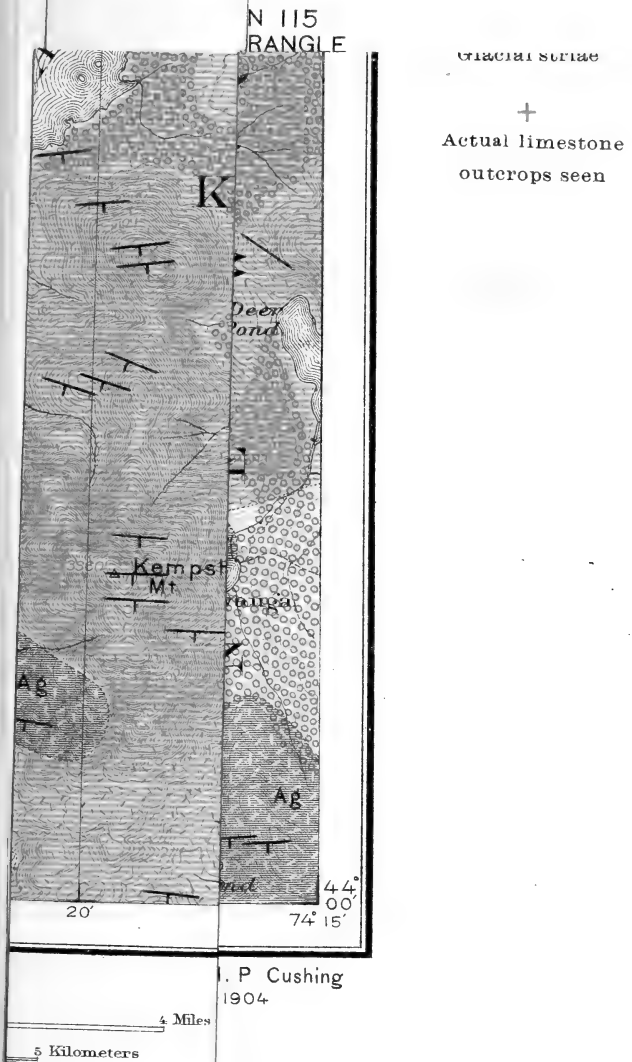

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RANGLE
Glacial striae
+
Actual limestone
outcrops seen
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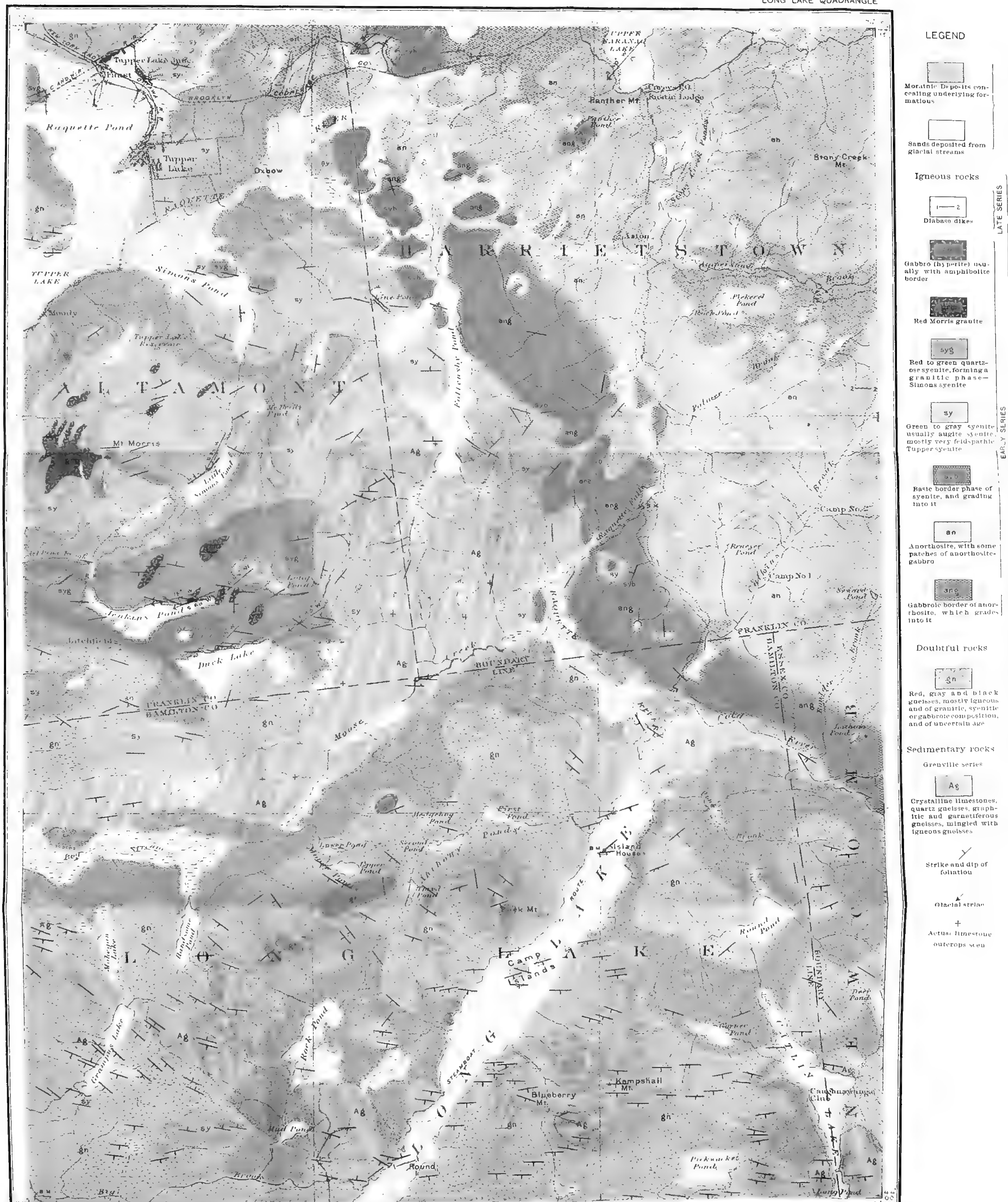
. P Cushing
1904
4 Miles
5 Kilometers

X

EDUCATION DEPARTMENT
JOHN M CLARKE
STATE GEOLOGIST

UNIVERSITY OF THE STATE OF NEW YORK
STATE MUSEUM

BULLETIN 115
LONG LAKE QUADRANGLE



Topography by U. S. Geological Survey
In Cooperation with the State of
New York. 1901-1902

Scale

Contour interval 20 feet
Datum is mean sea level

Geology by H. P. Cushing
1902-1904

2634

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BULLETIN 404 JULY 1907

New York State Museum

JOHN M. CLARKE, Director

CHARLES H. PECK, State Botanist

Bulletin 116

BOTANY 10

REPORT OF THE STATE BOTANIST 1906

ALBANY

NEW YORK STATE EDUCATION DEPARTMENT

1907

Price 35 cents

Mb103m-Ja7-2500

STATE OF NEW YORK

EDUCATION DEPARTMENT

New York State Education Department
Science Division, January 18, 1907

Hon. Andrew S. Draper LL.D.
Commissioner of Education

SIR: I communicate herewith, for publication as a bulletin of the State Museum, the annual report of the State Botanist for the fiscal year ending September 30, 1906.

Very respectfully

JOHN M. CLARKE
Director

State of New York

Education Department

COMMISSIONER'S ROOM

Approved for publication this 18th day of January 1907

A. S. Draper

Commissioner of Education

New York State Education Department

New York State Museum

JOHN M. CLARKE, Director
CHARLES H. PECK, State Botanist

Bulletin 116

BOTANY 10

REPORT OF THE STATE BOTANIST 1906

Dr John M. Clarke, Director of Science Division:

I have the honor of submitting to you the following report of work done in the botanical department of the State Museum during the year 1906.

Specimens of plants for the State herbarium have been collected in the counties of Albany, Columbia, Dutchess, Essex, Fulton, Greene, Hamilton, Herkimer, Madison, Oneida, Putnam, Rensselaer, Saratoga, Steuben, Suffolk and Warren.

Specimens of New York species have been received from contributors and correspondents, that were collected in the counties of Albany, Allegany, Chautauqua, Columbia, Essex, Fulton, Herkimer, Dutchess, Madison, Monroe, Oneida, Onondaga, Orange, Orleans, Rensselaer, Richmond, Saratoga, Steuben, Suffolk, Tompkins, Warren and Washington.

The number of species of which specimens have been added to the State herbarium is 156. Of these, 60 are species new to the herbarium, 96 are not new. Of the former number, 20 are considered new or undescribed species and descriptions of these will be found in another part of this report. A list of the names of added species is given under the title "Species added to the herbarium."

The number of those who have contributed specimens is 61. This includes many who have sent extralimital specimens or specimens simply for identification, but if the specimens were in good condition when received and were suitable or desirable for the herbarium they have been preserved and credited to the sender as a contribution. A list of the names of the contributors and their respective contributions will be found under the title "Contributors and their contributions."

The number of species found or of which specimens have been

contributed that are deemed new to our New York flora is 67. A record of these with their localities and descriptions of new species is given under the title "Species not before reported."

Descriptions of five new but extralimital species and one new variety have been added to this chapter.

A record of new stations of rare plants, of new varieties and forms of well known species, remarks concerning distinguishing characters of closely related species or observations of unusual features in some species are given under the title "Remarks and observations." The number of New York species noticed in this chapter is 27.

The study of our fleshy fungi and the collection of specimens of them for the herbarium have been continued, though much of the season has been singularly unfavorable to their production. Rain and showers were frequent in the early part of summer but the prevailing low temperature was detrimental to the growth of these plants. As the weather became warmer the rains ceased and excessive dryness prevented their growth. September is usually one of the best months of the year for mushroom growths, but this season it was one of the poorest. Late fall rains, however, brought out a delayed crop which was available at a much later date than usual and helped to make good the deficiency of the earlier part of the season. The number of species of fungi added to the herbarium is 39 of which 17 are new species.

The trial of the edible qualities of our wild mushrooms has resulted in adding 11 species to our list of those deemed edible, and makes the whole number of New York species of this class 183. Of the 11 added species 9 have been illustrated by colored figures of natural size. Figures of the 2 remaining species, Russula earlei Pk. and Boletus rugosiceps Pk. have been published in preceding reports. Descriptions of the 11 species tested and approved this year will be found under the title "Edible fungi."

The study of our Crataegus flora has been continued with much interest. Specimens have been collected in the northern, eastern, central and southwestern parts of the State. The number of species added to the State flora is 8, of which two are new species. This addition makes the number of New York species now known 97. Many specimens of this genus still remain undetermined. The destructive influence of late frosts was clearly seen in the failure of many thorn bushes which bore a full crop of flowers to

develop any fruit. The essential floral organs were frozen and consequently the fruit failed to develop. In such cases the stamens and pistils are sometimes frozen before the buds open. When the flowers appear they look fresh and fair at a distance but on close inspection the stamens and pistils are seen to be dead and blackened. If the freeze is very severe after the buds are much swollen no species escapes. If less severe, only the flowers of the most tender species or those which are in the most susceptible condition are killed. During the past season many species of the Tomentosae group failed to develop fruit though at flowering time they were full of blossoms. Species in the same locality whose time of flowering is earlier may escape injury.

The comparatively large genera Hygrophorus and Russula present some peculiar difficulties. The subgenera are not sharply differentiated and in some cases American species appear to combine characters of two subgenera or do not in all respects agree with the characters ascribed to any of the subgenera. Nevertheless a revision of the New York species of these genera has been attempted and the Friesian arrangement of the subgenera and species followed as far as possible. Descriptions have been rewritten and in some cases made more full and satisfactory.

The plan of identifying specimens of plants for correspondents and others who send or bring them to the office for that purpose has been followed. This not only results in the dissemination of useful botanical knowledge, but also in sometimes acquiring interesting and valuable specimens for the herbarium that otherwise might fail to reach it. The number of those for whom determinations of specimens have been made is 82. The number of determinations is 435.

Botanical specimens representing 20 species of trees have been collected but not included in the foregoing enumeration. They are intended to replace the lost or damaged specimens of the swinging frames, which loss occurred while these were absent at the St Louis and Portland expositions.

An additional table case of specimens of parasitic fungi has been prepared and placed in the botanical exhibition room. It contains specimens of 24 species some of which are injurious to cultivated plants, some to wild plants.

The case containing the specimens of the Japanese edible mushroom Shiitake, Pleurotus bretschneideri Kalchb., on the branches where they grew, has been repaired and placed on ex-

hibition. It is surmounted by a bell jar filled with the dried mushrooms in the condition in which they are offered for sale in the markets of China and Japan.

Mr S. H. Burnham, the Assistant Botanist, has been chiefly occupied with office work. He has incorporated the collections of 1905 in their proper places, has disinfected and labeled the specimens, attended to the correspondence of the office in my absence, identifying specimens sent for determination and giving information sought concerning them. He has prepared a card catalogue with descriptive references of the new species of fungi described by the State Botanist.

Respectfully submitted

CHARLES H. PECK

State Botanist

Office of the State Botanist

Albany, December 26, 1906

SPECIES ADDED TO THE HERBARIUM

New to the herbarium

Allionia hirsuta *Pursh*
Amanitopsis pulverulenta *Pk.*
Ascochyta pisi *Lib.*
Aster arcifolius *Bu.*
A. elaeagnus *Bu.*
A. fragrans *Bu.*
A. multiformis *Bu.*
A. violaris *Bu.*
Boletus subpunctipes *Pk.*
Caryospora cariosa *Fairm.*
Collybia campanella *Pk.*
C. lacerata *Lasch.*
Cortinarius intrusus *Pk.*
C. validipes *Pk.*
Crataegus arcana *Beadle*
C. bissellii *Sarg.*
C. cognata *Sarg.*
C. deltoides *Ashe*
C. habereri *Sarg.*
C. noveboracensis *Sarg.*
C. scabrida *Sarg.*
C. tenella *Ashe*
Cynoglossum boreale *Fern.*
Didymium clavus *(A. & S.) Rabenh.*
Dryopteris pittsfordensis *Slo.*
Entoloma minus *Pk.*
Flammula expansa *Pk.*
Gaura coccinea *Pursh*
Hydnum luteopallidum *Schw.*
Hygrophorus burnhami *Pk.*
Hygrophorus luridus *B. & C.*
Hypocrea pallida *E. & E.*
Inocybe pallidipes *E. & E.*
Lepiota asperula *Atk.*
L. eriophora *Pk.*
Leptoglossum fumosum *Pk.*
Linum medium *(Planch.) Britton*
Marasmius phyllophilus *Pk.*
Mycena albogrisea *Pk.*
Nicandra physaloides *Gaertn.*
Ohleria modesta *Fckl.*
Omphalia pusillissima *Pk.*
Panicum deminutivum *Pk.*
Peckiella hymenii *Pk.*
Phyllosticta ampelopsidis *E. & M.*
P. smilacis *E. & E.*
P. sphaeropsidea *E. & E.*
Pleurotus terrestris *Pk.*
Polyporus galactinus *Berk.*
Puccinia peckii *(DeT.) Kell.*
Russula foetentula *Pk.*
R. modesta *Pk.*
R. pectinatoides *Pk.*
R. vesca *Fr.*
Scleroderma tenerum *B. & C.*
Septoria lycopersici *Speg.*
Steccherinum adustulum *Banker*
Stemonitis smithii *Macb.*
Tricholoma hirtellum *Pk.*
Viola incognita *Brainerd*

Not new to the herbarium

Agastache scrophulariaefolia *(Willd.)*
Amanitopsis volvata *(Pk.) Sacc.*
Aquilegia canadensis *L.*
Arctium lappa *L.*
Asarum canadense *L.*
Aster camptilis *Bu.*
A. claytoni *Bu.*
A. concolor *L.*
Boletus auriporus *Pk.*
B. frostii *Russ.*
B. nigrellus *Pk.*
B. peckii *Frost*
Boletus rugosiceps *Pk.*
Bromus tectorum *L.*
Castanea dentata *(Marsh.) Borkh.*
Catastoma circumscissum *(B. & C.)*
Chrysomyxa pyrolae *(DC.) Rostr.*
Chrysopsis mariana *Nutt.*
Clavaria botrytoides *Pk.*
C. cristata *Pers.*
Clitocybe amethystina *(Bolt.)*
C. monadelpha *Morg.*
C. ochropurpurea *Berk.*
Clitopilus prunulus *(Scop.) Fr.*

Coreopsis rosea *Nutt.*
Cornus alternifolia *L. f.*
C. candidissima *Marsh.*
Crataegus caesariata *Sarg.*
C. coccinea *L.*
C. ferentaria *Sarg.*
C. illuminata *Sarg.*
C. intricata *Lange*
C. laneyi *Sarg.*
C. pedicellata *Sarg.*
C. pringlei *Sarg.*
C. punctata *Jacq.*
C. spissiflora *Sarg.*
C. tenuiloba *Sarg.*
Craterellus cantharellus (*Schw.*)
Cypripedium acaule *Ait.*
Daedalea quercina (*L.*) *Pers.*
Dasystoma virginica (*L.*) *Britt.*
Dryopteris boottii (*Tuck.*) *Under.*
D. cristata (*L.*) *Gray*
D. cris. clintoniana (*Eat.*)
D. simulata *Dav.*
Eleocharis inter. habereri *Fern.*
E. melanocarpa *Torr.*
Gentiana crinita *Froel.*
Hydnum aurantiacum *A. & S.*
H. fennicum (*Karst.*) *Sacc.*
H. imbricatum *L.*
H. repandum *L.*
H. vellereum *Pk.*
H. zonatum *Batsch*
Hypopitys lanuginosa (*Mx.*) *Nutt.*
Ilex vert. cyclophylla *Robins.*
Inocybe calamistrata *Fr.*
Irpex canescens *Fr.*
Lactarius ful. fumosus *Pk.*
L. pergamenus *Fr.*
Lactarius piperatus *Fr.*
L. vellereus *Fr.*
L. volemus *Fr.*
Lespedeza angustifolia *Pursh*
L. hirta (*L.*) *Ell.*
L. virginica (*L.*) *Britt.*
Lobelia dortmanna *L.*
Lycopus sessilifolius *Gray*
Meibomia marilandica (*L.*) *Kuntze*
M. rigida (*Ell.*) *Kuntze*
Monarda punctata *L.*
Mycena galericulata (*Scop.*)
Physarum lateritium (*B. & R.*)
Polyporus schweinitzii *Fr.*
P. sulphureus (*Bull.*)
Polystichum acrostichoides (*Mx.*)
Polystictus simillimus *Pk.*
P. subsericeus *Pk.*
Populus balsamifera *L.*
Russula earlei *Pk.*
Sagina procumbens *L.*
Scirpus atro. pycnocephalus *Fern.*
S. cyp. pelius *Fern.*
Senecio obovatus *Muhl.*
Solidago tenuifolia *Pursh*
Sporobolus serotinus (*Torr.*) *Gray*
Stereum versicolor *Fr.*
Strobilomyces strobilaceus (*Scop.*)
Trillium erect. album *Pursh*
Tricholoma alboflavidum *Pk.*
T. nudum (*Bull.*) *Fr.*
Viburnum lentago *L.*
Viola blanda *Willd.*
V. cucullata *Ait.*
V. fimbriatula *Sm.*
Woodwardia areolata (*L.*) *Moore*

CONTRIBUTORS AND THEIR CONTRIBUTIONS

Mrs E. B. Blackford, Boston Mass.

Lactarius varius *Pk.*
Omphalia epichysium *Pers.*
Hygrophorus serotinus *Pk.*

Miss M. B. Church, Albany

Pleurotus porrigens (*Pers.*) *Fr.*

Mrs M. S. DeCoster, Little Falls

Viola incognita *Brainerd*
Viola selkirkii *Pursh*

Mrs G. M. Dallas, Philadelphia Pa.
Opuntia humifusa *Raf.*

Miss Alice Eastwood, San Francisco Cal.
Lentinus magnus *Pk.*

Mrs L. L. Goodrich, Syracuse
Trillium erectum album *Pursh*

Mrs M. A. Knickerbocker, San Francisco Cal.
Scoliopus bigelovii *Torr.*

Miss E. A. Lehman, Winston-Salem N. C.
Monotropsis lehmanae *Burnh.*

Mrs J. Rogers, Ausable Forks
Lepiota naucinoides *Pk.*

Miss A. M. Ryan, New London Ct.
Marsonia violae *(Pass.) Sacc.*

Miss T. L. Smith, Worcester Mass.
Russula modesta *Pk.*

Mrs F. C. Sherman, Syracuse
Pleurotus ulmarius *Fr.*

Mrs C. E. Taft, New York city
Collybia velutipes *(Curt.) Fr.*

Mrs E. S. Tomlinson, New York city
Polystichum acrostichoides incisum *(Gr.) Under.*

F. H. Ames, Brooklyn
Ammodenia peploides *(L.) Bupr.* | Hudsonia tomentosa *Nutt.*
Woodwardia areolata *(L.) Moore*

J. C. Arthur, Lafayette Ind.
Aecidium coloradense *Diet.* | Peridermium boreale *Arth.*
Peridermium carneum *(Bosc) S. & E.*

G. F. Atkinson, Ithaca
Cortinarius intrusus *Pk.* | Lepiota asperula *Atk.*
Russula constans *Karst.*

H. J. Banker, Greencastle Ind.

Onygena equina *Pers.*
Steccherinum adustulum *Banker*

Elam Bartholomew, Stockton Kan.

Aecidium abundans *Pk.*
Ae. allenii *Clint.*
Ae. diodiae *Burr.*
Ae. grindeliae *Griff.*
Ae. grossulariae (*Pers.*) *Schm.*
Ae. pammelii *Trel.*
Ae. punctatum *Pers.*
Ae. solidaginis *Schw.*
Albugo amaranthi (*Schw.*) *Kze.*
A. candidus (*Pers.*) *Kze.*
Arthosporium compositum *Ell.*
Cercospora pachypus *E. & K.*
C. vignae *E. & E.*
Coleosporium solidaginis (*Schw.*)
Coniosporium arundinis (*Cd.*) *Sacc.*
Cronartium asclepiadeum *Berk.*
Cucurbitaria salicina *Fckl.*
Cudonia circinans (*Pers.*) *Fr.*
Diplodia liriodendri *Pk.*
Dothidea linderae *Ger.*
Exobasidium vaccinii (*Fckl.*) *Wor.*
Geaster pectinatus *Pers.*
Geoglossum hirsutum *Pers.*
G. peckianum *Cke.*
Gymnosporangium clavipes *C. & P.*
Humaria cestrica *E. & E.*
Hypomyces lactifluorum (*Schw.*) *Tul.*
Leotia lubrica (*Scop.*) *Pers.*
Macrosporium ornatissimum *E. & B.*
Marsonia castagnei (*D. & M.*) *Sacc.*
Massariella bufonia (*B. & Br.*) *Tul.*
Meliola nidulans (*Schw.*) *Cke.*
Mitrula olivacea (*Pers.*) *Sacc.*
M. serpentina (*Muell.*) *Mass.*
Oidium monilioides *Lk.*
Peronospora calotheca *DeBy.*
P. euphorbiae *Fckl.*
Phyllachora graminis panici (*Schw.*)
Plasmopara geranii (*Pk.*) *B. & DeT.*
Psilocybe sabulosa *Pk.*
Puccinia absinthi *DC.*
P. agropyri *E. & E.*
P. asparagi *DC.*
P. asteris *Duby*
P. caricis (*Schum.*) *Reb.*
P. cyperi *Arth.*
Puccinia fraxinate (*Lk.*) *Arth.*
P. helianthi *Schw.*
P. heucherae (*Schw.*) *Diet.*
P. lycii *Kalchb.*
P. menthae *Pers.*
P. muhlenbergiae *A. & H.*
P. physalidis *Pk.*
P. pimpinellae (*Strauss.*) *Lk*
P. prenanthis (*Pers.*) *Fckl.*
P. proserpinacae *Farl.*
P. purpurea *Cke.*
P. rubinella (*Pers.*) *Arth.*
P. silphii *Schw.*
P. stipae *Arth.*
P. tecta *E. & B.*
P. tosta *Arth.*
P. verbesinae *Schw.*
P. veroniae *Schw.*
Rhizographus fusariisporus *E. & E.*
Rhizopus nigricans *Ehrenb.*
Schizothyrella fraxini *E. & E.*
Sclerospora graminicola (*Sacc.*)
Scolecotrichum asclepiadis *E. & E.*
Septoria aurea destruens *E. & E.*
S. munroae *E. & B.*
Sorosporium syntherismae (*Pk.*) *Farl.*
Sphaeropsis cydoniae *C. & E.*
Stichopsora solidaginis (*Schw.*) *Diet.*
Teichospora populina *E. & E.*
Tricholoma portentosum *Fr.*
Tubercinia clintoniae *Kom.*
Tuberculina persicina (*Ditm.*) *Sacc.*
Typhula muscicola (*Pers.*) *Fr.*
Uromyces caladii (*Schw.*) *Farl.*
U. euphorbiae *C. & P.*
U. gentianae *Arth.*
U. glycyrrhizae (*Reb.*) *Magn.*
U. gnaphalii *E. & E.*
U. hordei *Tracy*
U. howei *Pk.*
U. junci (*Desm.*) *Tul.*
U. lespedezae (*Schw.*) *Pk.*
U. trifolii (*Hedw.*) *Lev.*
Ustilago utriculosa (*Nees*) *Tul.*
Xylaria digitata (*L.*) *Grev.*

M. S. Baxter, Rochester

Crataegus laneyi *Sarg.*
C. pedicellata *Sarg.*
Crataegus tenuiloba *Sarg.*
Pentstemon laevigatus *Soland.*

M. S. Baxter and V. Dewing, Rochester

Allionia hirsuta *Pursh*
Gaura coccinea *Pursh*
Conringia orientalis (*L.*) *Dum.*

R. C. Benedict, New York city

Dryopteris pittsfordensis *Slosson*

A. F. Blakeslee, Cambridge Mass.

Phycomyces nitens (*Ag.*) *Kunze*

F. S. Boughton, Pittsford

Clitocybe dealbata *Sow.*
Pleurotus subareolatus *Pk.*
Tricholoma columbetta *Fr.*

F. J. Braendle, Washington D. C.

Clavaria cinerea *Bull.*
Collybia zonata *Pk.*
Géaster saccatus *Fr.*
Isaria truncata *Pers.*
Mycenastrum spinulosum *Pk.*
Viola villosa *Walt.*

S. H. Burnham, Sandy Hill

Cordyceps capitata (*Holmsk.*) *Lk.*
Cynoglossum boreale *Fern.*
Erysiphe polygoni *DC.*
Flammula expansa *Pk.*
Hygrophorus burnhami *Pk.*
Lentinus spretus *Pk.*
Pleurotus terrestris *Pk.*
Polyporus borealis *Wahl.*
Polystichum acrostichoides (*Mx.*)
Russula cyanoxantha (*Schaeff.*) *Fr.*
Scapania irrigua (*Nees*) *Dum.*
Timmia megapolitana *Hedw.*
Lepiota asperula *Atk.*

G. H. Chadwick, Albany

Thelephora schweinitzii *Pk.*

G. D. Cornell, Coopers Plains

Arabis glabra (*L.*) *Bernh.*
Hieracium praealtum *Vill.*
Hypericum ascyron *L.*
Lilium canadense *L.*
Liriodendron tulipifera *L.*
Magnolia acuminata *L.*
Solidago juncea *Ait.*
Sisyrinchium angustifolium *Mill.*

W. C. Cottrell, Gloversville

Nicandra physaloides *Gaertn.*

Simon Davis, Brookline Mass.

Agaricus camp. hortensis *Cke.*
Coprinus plicatilis *Fr.*
C. stenocoleus *Lindb.*
Eccilia unicolor *Pk.*
Entoloma sericellum *Fr.*
E. sericeum *(Bull.) Fr.*
Galera sphagnorum *Pers.*
Hygrophorus davisii *Pk.*
Hygrophorus luridus *B. & C.*
H. mephiticus *Pk.*
H. nitratus *(Pers.) Fr.*
H. prat. albus *Sacc.*
Inocybe infelix *Pk.*
Leptonia transformata *Pk.*
Marasmius scorodonius *Fr.*
Psathyrella angusticeps *Pk.*
Russula compacta *Frost*

W. T. Davis, New Brighton

Aronia arbutifolia *(L.) Medic.*
Aronia atropurpurea *Britton*

Frank Dobbin, Shushan

Arthonia quintaria *Nyl.*
Arthonia radiata *(Pers.) Th. Fr.*
Discina orbicularis *Pk.*

Philip Dowell, Port Richmond

Dryopteris boottii *(Tuck.) Under.*
D. cristata *(L.) Gray*
D. crist. clintoniana *(Eat.)*
D. crist. marginalis *Dav.*
Dryopteris goldieana *(Hook.) Gray*
D. pittsfordensis *Slos.*
D. simulata *Dav.*
Woodwardia areolata *(L.) Moore*

C. E. Fairman, Lyndonville

Brachysporium obovatum *(Berk.) Sacc.*
Caryospora cariosa *Fairm.*
Didymium clavus *(A. & S.) Rabh.*
Nemosphaeria fairmani *Sacc.*
Ohleria modesta *Fckl.*
Physarum lateritium *(B. & R.) Rost.*

O. E. Fischer, Detroit Mich.

Agaricus camp. hortensis *Cke.*
Lepiota eriophora *Pk.*
Hydnum adustum *Schw.*

N. M. Glatfelter, St Louis Mo.

Guepinia palmiceps *Berk.*
Lepiota cep. lutea *With.*
Merulius rubellus *Pk.*
Pterula densissima *B. & C.*
Thelephora caespitulans *Schw.*

P. W. Graff, Storrs Ct.

Poronia macrospora *Pk.*
Xylaria polymorpha combinans *Pk.*

Cephas Guillet, Toronto Ont.

Hygrophorus miniatus *Fr.*
Lactarius paludinellus *Pk.*

C. C. Hanmer, East Hartford Ct.

Collybia lacerata *Lasch.*
Entoloma cuspidatum *Pk.*
Hygrophorus chlorophanus *Fr.*
Panus levis *B. & C.*

M. E. Hard, Chillicothe O.

Hydnum ochraceum *Pers.*
Tricholoma fumescens *Pk.*

J. J. Hare, Whitby Ont.

Hypholoma sublateritium squamosum *Cke.*

J. E. S. Heath, South Pasadena Cal.

Daldinia vernicosa (*Schw.*) *C. & D.*

A. P. Hitchcock, New Lebanon

Lycoperdon giganteum *Batsch*

G. S. Howell, Rockville Ind.

Tricholoma album *Schaeff.*

C. H. Kauffman, Ann Arbor Mich.

Crepidotus ralfsii *B. & Br.*
Cortinarius multiformis *Fr.*
Hypholoma vinosum *Kauff.*
Lepiota gracilis *Pk.*
Mycena glutinipes *Kauff.*
Pleurotus petaloides (*Bull.*) *Fr.*

W. A. Kellerman, Columbus O.

Galera kellermani *Pk.*
Psathyrella hirta *Pk.*

F. D. Kern, Lafayette Ind.

Puccinia graminis *Pers.*

R. B. Mackintosh, Peabody Mass.

Agaricus campester *L.*
Agaricus rodmani *Pk.*

Charles McIlvaine, Cambridge Md.

Lepiota morgani *Pk.*

George E. Morris, Waltham Mass.

Hygrophorus pallidus *Pk.*
H. ruber *Pk.*
Lepiota eriophora *Pk.*
Steccherinum adustulum *Banker*

L. J. Muchmore, Batavia

Hydnum luteopallidum *Schw.*
Oligonema nitens (*Lib.*) *Rost.*
Stemonitis smithii *Macb.*

F. M. Rolfs, Mountain Grove Mo.

Phyllosticta rubra *Pk.*

W. H. Ropes, Salem Mass.

Agaricus micromegethus *Pk.*

I. M. Shepherd, Trenton, N. J.

Morchella esculenta *(L.) Pers.*

F. S. Smith, Angelica

Bacillus amylivorus *Burr.*
Fusicladium pirinum *(Lib.) Fckl.*

Perley Spaulding, St Louis Mo.

Fomes annosus *Fr.*
Hydnum artocreas *Berk.*
Merulius lac. verrucifer *Quel.*
M. rubellus *Pk.*

E. B. Sterling, Trenton N. J.

Arachnion album *Schw.*
Calostoma cinnabarinum *Desv.*
Inocybe sterlingii *Pk.*
Lycoperdon excoriatum *Lloyd*
L. pusillum *Batsch*
L. serotinum *Bon.*
L. stellare *(Pk.) Lloyd*
Lycoperdon tessellatum *Lloyd*
Pholiota discolor *Pk.*
Pluteus petasites *Fr.*
Sarcoscypha dawsonensis *Pk.*
Scleroderma aurantiaca *Pers.*
S. cepa *Pers.*
S. verrucosum *(Bull.)*

D. R. Sumstine, Wilkinsburg Pa.

Pyronema leucobasis *(Pk.) Sacc.*

Hermann von Schrenk, St Louis Mo.

Paxillus panuoides *Fr.*
Trametes serialis *Fr.*

K. F. Symonds, Utica

Clitocybe ochropurpurea *Berk.*

E. A. White, Storrs Ct.

Phallogaster whitei *Pk.*

T. E. Wilcox, Washington D. C.

Boletus retipes *B. & C.*
B. rimosellus *Pk.*
B. subtomentosus *L.*
Clavaria pistillaris *L.*
Collybia strictipes *Pk.*
Hymenogaster anomalus *Pk.*
Tricholoma columbetta *Fr.*

W. W. Eggleston, New York city

By exchange

Crataegus arcana *Ashe*
C. coccinea *L.*
C. cognata *Sarg.*
Crataegus deltoides *Ashe*
C. dissona *Sarg.*
C. dodgei *Ashe*

Crataegus glaucophylla *Sarg.*	Crataegus modesta *Sarg.*
C. intricata *Lange*	C. pentandra *Sarg.*
C. matura *Sarg.*	C. pruinosa *Wendl.*

Crataegus tenella *Ashe*

SPECIES NOT BEFORE REPORTED

Allionia hirsuta Pursh

Near Rochester. August. M. S. Baxter and V. Dewing. Introduced from the western states. It is Oxybaphus hirsutus Sweet.

Amanitopsis pulverulenta n. sp.

Pileus thin, convex becoming nearly plane, pulverulent, squamose in the center, even on the margin, white or creamy white, odor feeble or none; lamellae thin, unequal, narrowed behind, free or nearly so, moderately close, subventricose, whitish; stem equal or slightly tapering upward, bulbous, solid, pulverulent or furfuraceous, white; spores subelliptic, .0003–.0004 of an inch long, .0002–.00024 broad.

Pileus 1–2 inches broad; stem 1–2 inches long, 2–3 lines thick. Shaded banks by roadsides. Port Jefferson, Suffolk co. August.

This species is well marked by its white color and the copious mealiness of the pileus and stem. It is apparently closely related to Amanitopsis pubescens (Schw.) but it differs from the description of that species in having the pileus and stem pulverulent instead of pubescent and in the former being squamose in the center. There is no annulus and the slight remains of a membranous volva are seen in very young specimens only. In the dried specimens the lamellae have assumed a pale yellowish cinnamon hue.

Ascochyta pisi Lib.

Living pods of peas and beans. Menands, Albany co. July. This parasitic fungus produces discolored spots on the pods similar to the anthracnose spots of bean pods, but the spores of this fungus are uniseptate, those of the anthracnose, simple.

Aster arcifolius Bu.

Lake Minnewaska, Ulster co. September. Prof. E. Burgess has made a special study of the asters of our country and his revision and elucidation of the Biotian division of the genus enables

me to add to our New York flora several species which were formerly supposed to be varieties of *Aster divaricatus*, *A. macrophyllus* and other closely related species.

Aster biformis Bu.

Rathboneville, Steuben co. and Voorheesville, Albany co. August and September. In this species the lower stem leaves are petiolate and cordate with a deep narrow sinus, the upper leaves are abruptly reduced to a smaller size and are nearly or quite sessile. This difference between the upper and lower leaves is suggestive of the specific name.

Aster camptilis Bu.

Low rocky ground. Lake Minnewaska. September. A slender aster with a weak stem which is often reclined or bent as if too feeble to support its own branches or hold itself erect. This character is suggestive of the name bent stemmed aster.

Aster claytoni Bu.

Open places. Menands, Albany co. September. A large and variable species belonging to the group Divaricati. Specimens are sometimes 3 feet tall.

Aster elaeagnus Bu.

North Elba, Essex co. August. A northern species having orbicular or ovate radical leaves and variable stem leaves which are pale and hairy on the under side. This gives a scurfy appearance suggestive of the scurfy character of Elaeagnus leaves. The species belongs to the group Macrophylli.

Aster fragrans Bu.

Round Lake, Saratoga co. September. This species differs from *A. divaricatus*, to which it was formerly referred, in its more persistent fragrance, more compact panicle of flowers and more truncate base of its leaves.

Aster multiformis Bu.

Lake Minnewaska, Ulster co. September. A species remarkable for its long slender rootstocks and the many forms shown by the leaves of the same plant.

Aster violaris Bu.

Rathboneville, Steuben co. August. This species is distinguished by its suborbicular and reniform apiculate radical and lower stem leaves. It belongs to the group Macrophylli.

Boletus subpunctipes n. sp.

Pileus fleshy, broadly convex, often uneven on the surface, becoming soft with age, brown, reddish brown when dry, flesh white, slowly becoming dingy where cut or broken, taste mild; tubes nearly plane in the mass, adnate or but slightly depressed around the stem, the mouths small, round, whitish or grayish white, changing to reddish brown where wounded; stem equal or nearly so, solid, slightly reticulate at the top, very minutely dotted, sometimes obscurely squamulose at the top, grayish or pallid; spores rusty brown or cinnamon brown, oblong or subfusiform, .0004–.0005 of an inch long, .0002–.00024 broad.

Pileus 2–4 inches broad; stem 2–3 inches long, 4–6 lines thick. Shaded sandy soil. Menands, Albany co. August.

The surface of the pileus is rendered uneven by coarse shallow depressions. The species belongs to the section Versipelles. The dots on the stem are nearly like those on the stem of Boletus chromapes Frost.

Caryospora cariosa Fairm.

In cavities of old beech wood. Lyndonville, Orleans co. C. E. Fairman.

Collybia campanella n. sp.

Pileus thin, conic or campanulate with a papilla at the apex, covered with coarse appressed or deflexed strigose hairs, dark tawny; lamellae ascending, moderately close, whitish; stem firm, equal, inserted, floccose hairy, colored like the pileus; spores not seen.

Pileus 3–4 lines broad; stem 9–12 lines long, .5 of a line thick. Dead and dry branches of arbor vitae, Thuja occidentalis. Horicon, Warren co. July.

This species is related to Collybia stipitaria from which it is readily distinguished by its persistently conic or campanulate pileus and its uniformly dark tawny color of both pileus and stem. The hairy tufts of the stem are pointed and project at right angles from the stem.

Collybia lacerata Lasch.

Dry soil among grasses and bayberry bushes. Fishers island, Suffolk co. October. C. C. Hanmer. In these specimens the expanded pileus is umbonate and the umbo is darker colored than the rest. The specimens agree well with the figure of the species as given in Cooke's *Illustrations of British Fungi*. The spores in our specimens are broadly elliptic or subglobose and .00024-.0003 of an inch long.

Cortinarius intrusus Pk.

Carnation beds in greenhouses. Highland Falls, Orange co. January. Ernest Palmer. Communicated by G. F. Atkinson. The species was described from specimens found growing in mushroom beds in conservatories in Massachusetts and New Jersey and communicated by R. Macadam and C. McIlvaine.

Cortinarius validipes n. sp.

Pileus fleshy, thick, convex becoming nearly plane, dry, squamulose or floccose squamulose, ochraceous, flesh white tinged with yellow next the lamellae, taste mild; lamellae thin, narrow, close, adnate or decurrent with a tooth, yellowish white becoming cinnamon; stem stout, firm, solid, fibrous, striate at the top by the decurrent teeth of the lamellae, subannulate from the adherent remains of the webby veil, yellowish white, whitish within; spores subelliptic, .0003-.0004 of an inch long, .0002-.00024 broad.

Pileus 3-6 inches broad; stem 4-5 inches long, 1-2 inches thick. Coopers Plains, Steuben co. September.

A cluster of six plants was found growing in a small excavation near a farmhouse. The weather had been unusually warm and dry for several weeks, but a soaking rain two days before and a thunder shower one day later seem to have been favorable to the development of this large fine mushroom. It belongs to the section Dermocybe.

Crataegus arcana Beadle

Moores Mills, Dutchess co. May and October. W. W. Eggleston.

Crataegus bissellii Sarg.

Rocky pasture, near Staatsburg, Dutchess co. May and September. Our plants differ from the typical form of the species only in having stamens 5-8 and anthers pale pink soon fading to white.

Crataegus cognata Sarg.

Colemans Station, Dutchess co. and Dykemans, Putnam co. May and September. Mr Eggleston had previously found it in the latter locality.

Crataegus deltoides Ashe

Moores Mills. May and October. W. W. Eggleston. The broadly ovate or deltoid leaves constitute a prominent feature of this species and are suggestive of the specific name.

Crataegus habereri n. sp. Sarg.

Leaves broadly ovate, acute, rounded, subtruncate or abruptly cordate at the wide entire or glandular base, finely doubly serrate above, with straight glandular teeth, and divided usually only above the middle into four or five pairs of small acuminate spreading lobes, nearly half grown when the flowers open about the middle of May and then membranaceous, light yellow green and roughened above by short white hairs and pale and glabrous below, and at maturity thin, dark yellow green and scabrate on the upper surface, light yellow green on the lower surface, 4.5–6.5 cm long and nearly as wide; with slender midribs, and their primary veins extending obliquely to the points of the lobes; petioles slender, slightly wing-margined at the apex, at first slightly villose, soon becoming glabrous, sparingly glandular while young, 2.5–3.5 cm in length; leaves on vigorous shoots truncate or rounded at the base, more coarsely serrate and more deeply lobed, often 7–8 cm long and 6–7 cm wide. Flowers 1.4–1.5 cm in diameter, on slender slightly hairy pedicels, in broad 5–8-flowered corymbs; calyx tube narrowly obconic, glabrous, or slightly hairy near the base, the lobes slender, acuminate, glandular serrate, glabrous on the outer, sparingly villose on the inner surface, reflexed after anthesis; stamens 10; anthers dark rose color; styles 3–5, surrounded at the base by a narrow ring of pale tomentum. Fruit ripening from the first to the middle of September, on glabrous reddish pedicels, in few-fruited drooping clusters, oval to obovate, crimson, lustrous, marked by large pale dots; calyx prominent, with a deep wide cavity, and incurved horizontal or recurved lobes dark red above toward the base and slightly hairy on the upper surface, their tips often deciduous from the ripe fruit; flesh thin, dark yellow, soft and succulent; nutlets 3–5, acute at the ends, slightly ridged and irregularly grooved on the back, 7–8 mm long and about 5 mm wide.

A shrub 3–5 m high, with small stems, wide spreading flexuous

branches, and slender slightly zigzag glabrous branchlets, light orange green when they first appear, becoming light chestnut-brown, lustrous and marked by pale lenticels in their first season, and dull reddish brown the following year, and armed with slender straight or slightly curved chestnut-brown spines 2.5–3 cm long.

Rocky pastures and margins of woods; New Hartford, Oneida co. J. V. Haberer (# 2410, type), May 20 and September 28, 1903; C. H. Peck, September 11, 1906.

This species, remarkable in its broad slightly lobed leaves and early ripening fruit, is named for its discoverer, Joseph Valentine Haberer M. D., an enthusiastic student of the flora of Herkimer, Oneida and Madison counties, the founder of the Asa Gray Botanical Club of Utica in 1886 and from that time to the present its president.

Crataegus noveboracensis n. sp. Sarg.

Leaves ovate, acuminate, abruptly concave cuneate at the entire base, finely doubly serrate above, with straight glandular teeth, and deeply divided into five or six pairs of narrow acuminate spreading lobes, more than half grown when the flowers open at the end of May and then thin, yellow green and covered above by short soft white hairs and paler and glabrous below, and at maturity thin but firm in texture, dark yellow green and lustrous on the upper surface and pale yellow green on the lower surface, 4.5–6.5 cm long and 4–5 cm wide, with slender yellow midribs, and thin primary veins arching obliquely to the points of the lobes; petioles slender, slightly wing-margined at the apex, villose on the upper side while young, becoming glabrous, sparingly glandular, 1–2 cm in length; leaves on vigorous shoots thicker, sometimes rounded or subtruncate at the broad base, more coarsely serrate and more deeply lobed, often 7–8 cm long and 6–7 cm wide, with stouter broadly winged petioles. Flowers 1.2–1.4 cm in diameter, on slender slightly villose pedicels, in usually 7–11-flowered lax corymbs; calyx tube narrowly obconic, coated especially near the base with long scattered white hairs, the lobes gradually narrowed, slender, acuminate, glandular serrate, glabrous on the outer, villose on the inner surface, reflexed after anthesis; stamens 15–20; anthers pale yellow; styles 4 or 5. Fruit ripening the middle of September, on slightly hairy reddish pedicels, in usually 5–7-fruited drooping clusters, subglobose to short oblong, full and rounded at the ends, crimson, lustrous, marked by large pale dots, about 1 cm in diameter; flesh thin, yellow, dry and mealy; nutlets 4 or 5, narrowed and rounded at the ends, slightly

ridged on the back, with a low slightly grooved ridge, 5.5–6 mm long and 4–5 mm wide.

A shrub 3–4 m high, with numerous small stems, ascending or suberect branches and slender nearly straight glabrous branchlets dark orange green when they first appear, becoming light chestnut-brown, lustrous and marked by pale lenticels in their first season and light gray brown the following year, and armed with numerous slender straight or slightly curved light chestnut-brown shining spines 4–5 cm long.

Sandy or rocky soil; Essex co. Common. North Elba, C. H. Peck (# 40, type), May 27, July 22 and September 14, 1903; C. H. Peck (40), Keene, May 31 and September 16, 1903.

Crataegus scabrida Sarg.

Hilly and rocky pastures. West Albany, Albany co., C. H. Peck; New Hartford, Oneida co., J. V. Haberer. May and September. This is a large shrub or small tree which occurs in several places about Albany. It also occurs in Petersburg, Rensselaer co. Its fruit is edible.

Crataegus tenella Ashe

Hilly and rocky pastures. Colemans Station and Moores Mills, Dutchess co.; Dykemans, Putnam co. May, September and October. W. W. Eggleston.

Cynoglossum boreale Fern.

West Fort Ann, Washington co. June. S. H. Burnham.

Didymium clavus (A. & S.) Rabenh.

Dead herbaceous stems. Grove Springs near Lake Keuka. July. C. E. Fairman. These specimens differ from typical forms in having a slightly smaller peridium.

Dryopteris pittsfordensis Slosson

Springville, Richmond co. May. Philip Dowell. Solway, Onondaga co. R. C. Benedict.

Entoloma minus n. sp.

Pileus thin, subconic or hemispheric, becoming broadly convex, glabrous, grayish brown, darker in the center; lamellae thin, close, ascending at first, sinuate behind, whitish becoming flesh color;

stem slender, hollow, white; spores subglobose, angular, .0003–.0004 of an inch in diameter.

Pileus 8–12 lines broad; stem 1–1.5 inches long, about 1 line thick. Ground in woods. East Schaghticoke, Rensselaer co. August.

Flammula expansa n. sp.

Pileus thin, broadly convex or nearly plane, glabrous or sometimes with appressed spotlike scales in the center, subochraceous, flesh white, taste mild; lamellae thin, narrow, close, yellow, changing to brown where wounded; stem short, equal, solid, brownish without, yellow within; spores broadly elliptic, .0003 of an inch long, .00024 broad.

Pileus 1–3 inches broad; stem about 1 inch long, 2–3 lines thick. Decaying wood of red maple, A c e r r u b r u m. Helderbergs, Albany co. July. S. H. Burnham. East Schaghticoke, Rensselaer co. August.

Gaura coccinea Pursh

Near Rochester. August. Introduced from the west. M. S. Baxter and V. Dewing.

Hydnum coriaceo-membranaceum Schw.

Ground. Lake Pleasant, Hamilton co.

Hydnum luteopallidum Schw.

Decorticated wood and bark of some deciduous tree, apparently butternut, J u g l a n s c i n e r e a. Lyndonville, Orleans co. July. L. J. Muchmore. The type specimens of Schweinitz were found on grapevines. In ours the fungus is resupinate, adnate, with a very thin subiculum, smoky yellow or brownish, whitish or pale yellow on the young margin; the teeth are scarcely half a line long, scattered or crowded, sometimes confluent at the base and subfasciculate, colored like the subiculum but white fimbriate at the tips; spores subglobose, colored, verrucose, .00016–.0002 of an inch broad.

Hygrophorus burnhami n. sp.

Ground. West Fort Ann, Washington co. October. The description of this species may be found in the chapter on New York Species of Hygrophorus.

Hygrophorus luridus B. & C.

Among mosses and fallen leaves in woods. Sand Lake, Rensselaer co. August.

Hypocrea pallida E. & E.

On some resupinate polyporoid fungus on oak branches. Lake Minnewaska, Ulster co. August.

Inocybe pallidipes E. & E.

Dead wood and decaying vegetable matter, near Friends lake, Warren co. July.

The white stem and brown umbonate pileus are prominent and notable characters of this species. Wood inhabiting species of this genus are few. This one is related to Inocybe eutheloides Pk. but it is a stouter plant with a thicker, straighter stem which is white even in the dried state.

Lepiota asperula Atk.

Woods. Near Ithaca. August. G. F. Atkinson. Vaughns, Washington co. July. S. H. Burnham. This last is a form having a more slender stem and slightly darker pileus, but scarcely worthy of specific distinction.

Lepiota eriophora Pk.

Jamestown, Chautauqua co. August. G. E. Morris. This is distinguished from the preceding species by its smaller size, darker brown color, denser crowded scales of the pileus and specially by the copious brown tomentum of both pileus and stem, a character suggestive of the specific name. It has not yet been found in the eastern part of the State. Its range is apparently westward and southward.

Leptoglossum fumosum Pk.

Geoglossum luteum fumosum, State Mus. Rep't 43. 1890. p. 40.

Receptacle fleshy, stipitate, oblong, obtuse, terete or compressed and furrowed on one or both sides, glabrous, moist, hollow, distinct from the stem and sometimes with one or two decurrent lobes at the base, 3–6 lines long, 1.5–3 lines broad, smoky yellow; stem equal or nearly so, glabrous, hollow, about as long as the receptacle, slightly darker; asci subclavate or cylindric; spores oblong, biseriate, often slightly curved, hyaline, 2–4-nucleate, .0012–.0016 of an inch long, .00016–.0002 broad.

Mossy ground in woods. Sand Lake. August. This was formerly considered a mere variety of Leptoglossum luteum, but having found a group of good specimens showing well the distinctive characters of the species it seems worthy of specific rank.

Linum medium (Planch.) Britton

Hempstead Plains, Nassau co. July.

Lycoperdon excoriatum Lloyd

Warrensburg, Warren co. October. The specimens referred to this species were found growing about the roots of an old stump in a pasture. They are either scattered or gregarious in their mode of growth. The peridium is grayish brown and umbonate and has a cortex similar to that of Lycoperdon gemmatum Batsch but it usually separates and falls away in flakes or patches, a character suggestive of the specific name. Sometimes the larger spinules fall away separately, as in L. gemmatum, leaving a scar on the peridium and showing the close relationship between the two species.

Lycoperdon polytrichum Lloyd

Among hair cap mosses, Polytrichum juniperinum. Piseco, Hamilton co. August and September. Closely related to L. gemmatum, but differing in its peculiar habitat.

Lycoperdon serotinum Bon.

Decaying wood, old stumps and prostrate trunks of trees. September to November. Appearing like a late smooth form of Lycoperdon pyriforme Schaeff.

Marasmius phyllophilus n. sp.

Pileus membranaceous, convex or nearly plane, dry, strongly rugose striate or rugose sulcate, whitish, with a faint pinkish tinge when dry; lamellae narrow, distant, rounded behind, adnexed, white, the interspaces venose; stem tough, slender, equal, inserted, hollow, covered with a whitish downy or velvety pubescence; spores .0002–.00024 of an inch long, .00012–.00016 broad.

Pileus 4–8 lines broad; stem 10–15 lines long, about .5 of a line thick. Gregarious on fallen leaves in woods. Wading River, Suffolk co. August.

Closely related to M. insititius Fr. from which it is separated by the attachment of the lamellae to the stem and by the white color and pubescent coating of the stem. The spores also are larger than the dimensions of the spores of that species.

Mycena albogrisea n. sp.

Pileus thin, submembranaceous, ovate or subcampanulate, obtuse, glabrous, sulcate striate, grayish white; lamellae rather thick, broad, distant, adnate, colored like the pileus; stem slender, glabrous, hollow, paler than the pileus, with a whitish strigose villosity at the base; spores .0003 of an inch long, .00016–.0002 broad.

Pileus 3–5 lines broad, nearly as long; stem 1–2 inches long, about half a line thick.

Attached to fallen leaves of coniferous trees. Bolton, Warren co. September. It belongs to the section Basipedes. In the dried specimens the pileus has assumed a slightly darker or smoky tint, but it still retains its sulcate striate character.

Nicandra physaloides Gaertn.

Gloversville, Fulton co. September. W. C. Cottrell. Introduced from Peru. The common name of its fruit is apple of Peru. In *Illustrated Flora of the Northern States and Canada* its name is given as Physalodes physalodes (L.) Britton, but the International Botanical Congress having decided against the use of double names, we have used the name given in Gray's *Manual.*

Omphalia pusillissima n. sp.

Pileus membranaceous, broadly convex or nearly plane, glabrous, umbilicate, slightly striate on the margin when dry, white; lamellae few, distant, decurrent, white; stem slender, filiform, flexuous, glabrous, white; spores subglobose or broadly elliptic, .0002–.00024 of an inch long, .00016–.0002 broad.

Pileus 1–2 lines broad; stem 3–5 lines long. On humus and decaying twigs under pine trees. Delmar, Albany co. August.

This is one of the smallest species of Omphalia known to me. The lamellae are very narrow, sometimes branched and sometimes absent. It is a smaller mushroom than Omphalia integrella, and differs from it in its umbilicate pileus. The stem is hollow but the cavity is minute.

Ohleria modesta Fckl.

On carious wood of beech. Lyndonville, Orleans co. March. C. E. Fairman.

Panicum deminutivum n. sp.

Culms 4–10 inches tall, slender, erect, branched, slightly hairy near the base; branches 3–6, short, suberect, each terminating in a

panicle, occasionally bearing one or two branchlets; radical leaves lanceolate, sparingly villose, 3–6 lines long, cauline leaves narrowly lanceolate or linear, acuminate, 6–12 lines long, 1–1.25 lines broad, minutely pubescent beneath, glabrous above, or one or two lower ones sometimes with a few long scattered hairs, the sheaths mostly shorter than the internodes and minutely pubescent, stipules a tuft of slender bristlelike hairs .5–1 line long; panicles ovate in outline, 6–12 lines long, the branches and pedicels glabrous, spikelets subglobose or oval, less than .5 of a line long, the first scale minute, glabrous or nearly so, second and third scales nearly equal in length, minutely pubescent, the second commonly purplish.

Moist or wet muddy soil. Shore of Little pond about 2.5 miles south of Wading River, Suffolk co. August.

This diminutive panic grass has smaller spikelets than any species I find described. In most of its characters it approaches closely to Panicum psammophilum Nash from which I have separated it because of the smaller size of all its parts, its different mode of growth and different habitat. This is wet humus or decomposed vegetable matter which is apparently submerged in times of high water. The mode of growth is scattered, not cespitose, and the pubescence except at the base of the stem is so minute that it is scarcely visible to the naked eye. Unless carefully examined with a magnifying glass the plants would be considered glabrous.

Peckiella hymenii n. sp.

Subiculum white, overrunning the hymenium of the host plant and obliterating the lamellae, sometimes interrupted; perithecia minute, globose, semiimmersed in the subiculum, numerous, pale honey color becoming darker with age; asci linear, .009–.013 of an inch long, .0003–.0004 broad; spores monostichous, fusiform, acute at each end, hyaline, .0016–.0018 of an inch long, .00025–.0003 broad, oozing from the perithecia and forming irregular whitish masses upon them.

On the hymenium of Lactarius vellereus Fr. Wading River, Suffolk co. August.

The parasite in all the specimens seen, is limited to the hymenium of the host plant, the upper surface of the pileus and the stem remaining unchanged. The host plant also retains its acrid taste. The perithecia are so numerous that they give a general pallid hue to the parasite, though the subiculum itself is white. The emitted spores, adhering in minute masses, do not cover the surface with

a white pulverulence as the spores of the related Hypomyces lactifluorum (Schw.) Tul. do.

Peramium tessellatum (Lodd.) Rydb.

Woods. Floodwood, Franklin co. North Elba, Essex co. August. This may be separated from Peramium repens (L.) Salisb. by its spiral arrangement of the flowers of the spike.

Peridermium consimile A. & K.

Living leaves of spruce trees. Common in the swamps and on the mountains of the Adirondack region where it is associated with Peridermium decolorans Pk. from which it may be distinguished by its smaller spores.

Phyllosticta ampelopsidis E. & M.

Living leaves of woodbine, Ampelopsis quinquefolia. Wading River, Suffolk co. August.

Phyllosticta smilacis E. & E.

Living leaves of greenbrier, Smilax rotundifolia Mx. Wading River, Suffolk co. August.

Phyllosticta sphaeropsidea E. & E.

Living leaves of horse chestnut, Aesculus hippocastanum L. Port Henry, Essex co. September.

Pleurotus terrestris n. sp.

Pileus thin, broadly convex, even, glabrous, moist, whitish; lamellae thin, close, broad, slightly emarginate, adnexed, whitish; stem equal, even, curved, glabrous, solid, eccentric, whitish; spores white, globose, .00028–.00032 of an inch broad.

Pileus 2–3 inches broad; stem 2–3 inches long, 3–4 lines thick. Cespitose. On the ground in the margin of woods, West Fort Ann, Washington co. October. S. H. Burnham.

This species belongs to the section Eccentrici, group Tricholomatarii.

Polyporus galactinus Berk.

Trunks of apple trees. Delmar, Albany co. August. The fresh young specimens are white, but in drying they assume a pale straw color which in time becomes a dingy yellow. The spores in our examples are subglobose, .00016–.0002 of an inch broad.

Puccinia peckii (DeT.) Kell.

On hairy fruited sedge, Carex trichocarpa. North Greenbush. This is the teleutospore form. The aecidial form occurs on living leaves of evening primrose, Onagra biennis (L.) Scop. This form occurs in summer, the other in autumn.

Russula foetentula Pk.

The description of this species may be found in the chapter on "New York Species of Russula."

Russula modesta Pk.

For description see chapter on "New York Species of Russula."

Russula pectinatoides Pk.

The description of this species may be found in the chapter on "Edible Fungi."

Russula vesca Fr.

Woods. Bolton Landing, Warren co. August.

Scleroderma tenerum B. & C.

This is a small Scleroderma, scarcely attaining a diameter of 1 inch, and having a thin grayish or grayish yellow peridium spotted by very small appressed brownish scales. It is gregarious or sometimes cespitose in its mode of growth. It is not rare, but has been confused with another species both in this country and in Europe.

Septoria lycopersici Speg.

Living leaves of tomato. Menands. July. This parasitic fungus produces spots on the leaves and finally discolors the whole leaf and kills it. It is an injurious species.

Steccherinum adustulum Banker

On dead wood and sticks. Jamestown, Chautauqua co. G. E. Morris. East Schaghticoke, Rensselaer co. July. H. J. Banker. This species differs from the common Hydnum adustum Schw. or its equivalent Steccherinum adustum Banker, in its smaller size and its persistently white or whitish pileus and spines or teeth. Its spores are also a little shorter than in that species.

Stemonitis smithii Macb.

Decaying wood. Lyndonville, Orleans co. July. L. J. Muchmore.

Tricholoma hirtellum n. sp.

On or about pine stumps. Wading River, Suffolk co. August. The description of this species may be found in the chapter on "Edible Fungi."

Viola incognita Brainerd

Damp or moist ground. Little Falls. Mrs M. S. DeCoster. Sand Lake, Rensselaer co. May.

NEW EXTRALIMITAL SPECIES OF FUNGI

Phallogaster whitei

Peridium subglobose, 4–5 lines broad, abruptly contracted below into a cylindric stem about 4 lines long and 1 line thick, stellately or radiately rupturing when mature, the rays recurved; glebe masses greenish, becoming black in drying, separated from each other by a white slightly lobed columella, the lobes not reaching the inner surface of the peridium; spores minute, oblong, .00016–.0002 of an inch long.

Much decayed wood. Storrs, Ct. July. E. A. White. Closely allied to Phallogaster saccatus Morg. but distinct in its smaller size, differently shaped peridium, different mode of rupture, more distinct cylindric stem and different internal structure. Like that species it has an abundance of white branching mycelial strands. It is dedicated to its discoverer.

Hymenogaster anomalus

Peridium thin, subglobose, 9–12 lines in diameter, glabrous, slightly lacunose, often with a rootlike strand of mycelium at the base, whitish, sometimes tinged with red above, white and cellular within, the cells empty, .5–1 line in diameter, sterile base obsolete or nearly so, odor slight, not disagreeable; spores globose or broadly elliptic, even, hyaline, uninucleate, .0004–.00055 of an inch long, .00035–.0005 broad.

Near Washington, D. C. August and September. T. E. Wilcox. This species is most closely related to Hymenogaster thwaitesii B. & Br. by its subglobose spores, but it may be separated by its white substance, its smoother colorless spores and

its cordlike strand of mycelium. This last character is unusual in this genus and suggestive of the specific name.

Leptonia transformata

Pileus thin, submembranaceous, slightly convex or nearly plane, often umbilicate, silky tomentose, dry or slightly moist in wet weather, striatulate on the margin which is at first incurved, sometimes becoming wavy or split when old, white, flesh white, taste farinaceous; lamellae sinuate, adnexed, close, unequal, ventricose, white becoming pink; stem long, slender, straight or flexuose, equal or slightly narrowed upward, pruinose at the top, glabrous and shining below, subcartilaginous, stuffed or hollow, white with a white mycelium at the base; spores flesh colored, angular, uninucleate, .0004–.0005 of an inch long, .0003–.00035 broad.

Pileus 5–10 lines broad; stem 1–2 inches long, .5–1 line thick. Bushy places. Falmouth, Mass. July. S. Davis. Both pileus and stem become blackish or blackish brown in drying and the pileus becomes deeply umbilicate and strongly striate from the margin to the umbilicus. These changes give the dried plant an appearance quite unlike that of the fresh one.

Hygrophorus ruber

Pileus thin, conic, commonly unexpanded, acute or subobtuse, cuspidate or narrowly umbonate, very viscid or glutinous, bright red, not turning black in drying; lamellae narrow, ascending, adnexed, subdistant, yellow or yellowish brown; stem equal, viscid, hollow, colored like the pileus; spores subelliptic, .00024–.0003 of an inch long, .00016–.0002 broad.

Pileus .5–2 inches broad; stem scarcely 1 inch long, 1 line thick. Among mosses in wooded swamps. Ellis, Stow, Cohasset, Mass. September. G. E. Morris.

Distinct from H. conicus in its usually smaller size, more viscid pileus, bright red stem and persistent unchanging color in drying.

Hygrophorus serotinus

Pileus fleshy but thin, convex or nearly plane, often with the thin margin curved upward, glabrous or with a few obscure innate fibrils, reddish in the center, whitish on the margin, flesh white, taste mild; lamellae thin, subdistant, adnate or decurrent, white, the interspaces slightly venose; stem equal, stuffed or hollow, glabrous, whitish; spores white, elliptic, .0003 of an inch long, .0002 broad.

Pileus 8–15 lines broad; stem about 1 inch long, 1.5–2.5 lines thick.

Gregarious or cespitose in woods of oak and pine. Shore of Hammond pond near Boston, Mass. November. Mrs E. B. Blackford. This species is similar in size and color to Hygrophorus queletii Bres. but that species is described as having the margin of the pileus viscid when young and adorned with white flocci, the center of the pileus covered or spotted with reddish squamules or flocci and at length rimose areolate, the lamellae tinged with citrine yellow, the stem solid and furfuraceous or squamulose and the habitat is said to be larch woods only. None of these characters is applicable to our plant. It also resembles H. subrufescens Pk. in size and color but it differs from it in its more glabrous pileus with paler margin, its white flesh, stuffed or hollow stem and later time of appearance. This last character is suggestive of the name given to the species.

Xylaria polymorpha combinans n. var.

Club subglobose, often compressed and irregular, cespitose at the top of a common subterranean stem or of two stems united at the top; perithecia and spore character as in the species.

Growing from roots of a dead maple tree. Bridgeport, Ct. November. P. W. Graff. The subterranean stem is about 2.5 inches long, the clubs 1–1.5 broad. The clubs appeared as if resting on the ground. The subglobose shape of the club or stroma is characteristic of X. polymorpha hypoxylea Nits. and the cespitose mode of growth, of X. polymorpha spathulata Pers. This combination of characters of two varieties in one is suggestive of the varietal name here given.

REMARKS AND OBSERVATIONS

Agastache scrophulariaefolia (Willd.) Kuntze

This is a very variable species. A peculiar form occurs near Port Jefferson, in which the leaves are abruptly acuminate or cuspidate and the upper ones are entire or nearly so. The flower spikes are more narrow than usual and are sometimes interrupted toward the base.

Boletus nigrellus Pk.

A form of this extremely rare species was found in Sand Lake in which the pileus is yellowish or greenish yellow when fresh, and

its flesh, as well as the tubes and stem, slowly changes to a dingy flesh color and then to black or blackish where wounded, as in the type.

Castanea dentata (Marsh.) Borkh.

There is a chestnut tree near Freehold, Greene co., in which the involucre of the fruit is rudimentary or abortive. It consists of a mere shallow cup or rim which surrounds the base of the fruit. The tree is known to the inhabitants of the place as the burless chestnut. It blossomed freely the past summer but failed to develop fruit. It is said that the boys are so eager for the nuts that the owner of the tree realizes but small returns from it. As it is the only tree of its kind known to us it would seem desirable that it should be perpetuated either by planting its seeds or grafting scions of it on other chestnut trees.

Catastoma circumscissum (B. & C.) Morg.

This curious little puffball which ruptures at the base when mature, as indicated by the generic name, is more plentiful in more western regions. It has been found in two localities in our State, one in St Lawrence county, the other in Essex county.

Chrysomyxa pyrolae (DC.) Rostr.

As indicated by the specific name, this species usually inhabits the living leaves of various kinds of Pyrola, but the uredo spores were discovered the past season near Friends lake, inhabiting living leaves of Moneses uniflora (L.) Gray. July.

Clavaria bicolor Pk.

This name, being antedated by Clavaria bicolor Mass. was changed in *Sylloge* 17, page 196 to Clavaria peckii Sacc. & D. Sacc. This name having previously been used in *Sylloge* 9, page 249, was not available in this case. Therefore the name Clavaria vestitipes is here substituted for Clavaria bicolor in N. Y. State Museum bulletin 54, page 954.

Craterellus cantharellus (Schw.) Fr.

A form of this mushroom occurred plentifully the past season near Menands. The hymenium was distinctly marked by branched and anastomosing folds or narrow blunt edged lamellae, so that the plants might easily be mistaken for the common yellow chantarelle.

In the dried specimens the folds have disappeared from the hymenium near the stem but they are very distinct toward the margin. In other respects these mushrooms maintain the characters of the species. We propose for them the name Craterellus cantharellus intermedius n. var. The hymenium is intermediate in character between that of Cantharellus and Craterellus.

Dryopteris simulata Dav.

Fine specimens of this delicate fern were found near "Merrell Avenue," Richmond co. by Mr P. Dowell and contributed by him to the State herbarium.

Eleocharis intermedia habereri Fern.

Sandy shore of Oneida lake at Lewis point, Madison co. August. J. V. Haberer. In this variety the bristles are rudimentary or entirely wanting.

Fusarium sclerodermatis Pk.

This name is antedated by Fusarium sclerodermatis Oud. The New York fungus has the same habitat as the other and is so closely related to it that, in our opinion, it is only a less fully developed form of it.

Inocybe calamistrata Fr.

A form of this species sometimes occurs in which the usual dingy blue tint at the base of the stem is wanting. Such specimens were collected near Friends lake in July. They were growing with the normal form.

Irpex canescens Fr.

Fine specimens of this species were found in woods near Wading River. They were growing on dead branches of an apple tree, and developed on the underside of the branches. On branches less than an inch thick, a free margin projected 3 or 4 lines on each side. The hymenium of these margins had the appearance of the hymenium of some Lenzites, the plates being lamellalike and running at right angles to the axis of the branch and parallel to each other, occasionally branching or anastomosing.

Lactarius pergamenus Fr.

This mushroom seems to intergrade with Lactarius piperatus Fr. Specimens sometimes occur that might with almost equal propriety be referred to either species. But specimens were found

near Wading River in which the prominent distinguishing characters of the species were so well expressed that the identity of the species could be easily recognized. The thin, narrow and very crowded lamellae and the thin and flexible pileus were satisfactorily shown.

Lobelia dortmanna L.

In Gray's *Manual* the water lobelia is described as being 5–12 inches high; in Britton and Brown's *Illustrated Flora,* 6-18 inches. Specimens of this plant were collected in Friends lake that are 30–35 inches tall. They grew in deep water which is evidently one factor in determining the length of the stem.

Lycoperdon pedicellatum Pk.

On account of the permanently pedicellate spores of this very distinct puffball the species has been transferred from the genus Lycoperdon to Bovistella and bears the name Bovistella pedicellatum (Pk.) Lloyd.

Panus fulvidus Bres.

So far as can be ascertained from the descriptions of this species of mushroom and Lentinus sulcatus Berk. they are specifically the same. The uneven or denticulate edge of the lamellae of L. sulcatus is not mentioned in the description of P. fulvidus, but in the other characters there appears to be complete agreement. The specimens which in State Museum bulletin 105, page 26 are referred to P. fulvidus have the eroded or denticulate edge of the lamellae ascribed to Lentinus sulcatus and as this species antedates Panus fulvidus our specimens should take the name Lentinus sulcatus Berk. This species was founded on specimens collected in Ohio.

Paxillus panuoides Fr.

A singular form of this species was found at Glens Falls by Dr H. von Schrenk growing on pulp paper that had been stored for a considerable time in an inclosure where there was not much light. Both habitat and place were unusual and evidently had a modifying influence on the character of the specimens. Some of them were 4 inches long, including the narrowed stemlike base, and 2 or 3 inches broad. They were nearly white when fresh but in drying they gradually assumed a yellowish tint approaching the normal

color of the species. Smaller specimens were found growing near these but in a more exposed place. These had the usual color of the species.

Peziza (Mollisia) typhae Pk.

This name is antedated by Peziza (Mollisia) typhae Cke. Though bearing the same name the two fungi appear to be quite distinct. In the New York species the cups are superficial and the disk is much paler than in the other and the spores are much smaller. We therefore substitute the name Mollisia pallidior for Peziza (Mollisia) typhae Pk. in New York State Museum Report 32, page 47.

Physarum lateritium (B. & R.) Rost.

Bark in woods. Lyndonville, Orleans co. Autumn. Scarce. C. E. Fairman. The Lyndonville specimens differ from the typical form in having the lime granules of the peridium and the nodules of the capillitium yellow instead of red.

Polystichum acrostichoides incisum (Gr.) Under.

Pound Ridge, Westchester co. July. Mrs E. S. Tomlinson The specimen is a very broad one, the frond being nearly 6 inches broad in its widest part. The fruiting pinnae are not abruptly reduced in size as in the ordinary form of the species.

Populus balsamifera L.

In the town of Sand Lake, Rensselaer co. there is an outlying and unusually southern station of this northern tree, the balsam poplar. The trees are few in number but they have existed there for many years. Those bearing pistillate aments predominate, but staminate aments are borne by at least one tree. The location is so far south of the general range of the species that late frosts often kill the early starting blossoms and prevent the development of fruit. Sometimes when this does not occur the crop of pollen seems to be insufficient for the general pollination of the pistillate blossoms. Last spring many pistillate aments were found with only three or four fruit pods developed, the others having prematurely fallen. The lack of proper pollination was probably the cause.

The leaves on the older and less vigorous branches are somewhat rhomboidal and pointed at both ends, but those on young and vigorous branches are more ovate and broadly rounded or even truncate at the base. Both kinds of leaves grow on different branches of

the same tree. The species is northern in its range and is common in the Adirondack region.

Sagina procumbens L.

Crevices of walls and pavements. Utica. September. This is an unusual location for the procumbent pearlwort. Its occurrence here was made known to me by Dr Haberer. It forms rather dense compact mats. In Paine's *Catalogue of Oneida County Plants* its habitat is given as "wet sandy banks and shores." It is recorded as "rare" but no definite station is mentioned.

Scirpus atrovirens pycnocephalus Fern.

Shore of Oneida lake at Lewis point, Madison co. August.

Scirpus cyperinus pelius Fern.

Open woods 3 miles south of Utica. August. J. V. Haberer. Near Frankfort, Herkimer co. September. C. H. Peck.

Trametes serialis Fr.

On pulp paper. Glens Falls. October. H. von Schrenk. The specimens are white throughout and therefore the growth of the present season. The usual habitat in the Adirondack region is dead wood of spruce.

Trillium erectum album Pursh

Near Syracuse. May. Mrs L. L. Goodrich. In the contributed specimen the petals are yellowish. This form has been unusually plentiful this year and might easily be considered as good a variety as the form with white petals.

Viola cucullata Ait.

A peculiar form of this species occurs in North Greenbush. In it the scapes are about as long as the leaves, the tips of the petals are white or whitish and also the basal angles of some of the leaves.

EDIBLE FUNGI

Tricholoma hirtellum n. sp.

HAIRY CAP TRICHOLOMA

PLATE 105, FIG. 1–5

Pileus fleshy, thin, convex, subumbonate, dry, hairy, pale brown, flesh white, taste mild; lamellae thin, narrow, close, slightly sinuate,

adnexed, minutely floccose on the edge, yellowish white or pallid; stem slender, equal, stuffed or hollow, with a very small cavity, fibrillose or subsquamulose, colored like or a little paler than the pileus; spores subglobose, .00024–.0003 of an inch long, .0002–.00024 broad.

The hairy cap tricholoma grows in tufts or singly on or about pine stumps in Wading River, Suffolk co. and occurs in August. It is a very rare species and has been found but once. It is related to Tricholoma albofimbriatum Trog., from which it is separated by its hairy cap, white flesh and less crowded gills not fimbriate on the margin. The hairs of the cap are often collected in minute tufts giving the cap an appearance similar to that of the brownish caps of the honey-colored armillaria, but unlike that species it never has a collar on the stem. The caps are 1–1.5 inches broad, the stem 2–3 inches long and 2–3 lines thick.

Tricholoma nudum (Bull.) Fr.

NAKED TRICHOLOMA

PLATE 104, FIG. 1–9

Pileus thin, broadly convex, nearly plane or slightly depressed in the center, obtuse or occasionally slightly umbonate, incurved on the thin naked margin when young, pale violaceous or lavender, fading with age and the escape of moisture to a pale grayish brown, often slightly tinged with reddish or yellowish hues, flesh of the young plant tinged with the color of the pileus, becoming white with age, taste mild; lamellae thin, narrow, close, slightly sinuate, adnate or decurrent, colored like the pileus when young, becoming whitish with age; stem firm, equal, fibrous, stuffed or hollow, colored like the pileus; spores pale flesh color in mass, elliptic, .00024–.0003 of an inch long, .00012–.00016 broad.

The naked tricholoma is a rare species with us. The specimens tested and figured on plate 104 were collected in Electric park, Columbia co., October 29, by Mr S. H. Burnham. The plants were found growing in flower beds, either singly or in clusters, and when young and fresh they are throughout of a beautiful violet color approaching lavender, but this color fades and changes with age and with the escape of moisture and the cap becomes a pale pinkish gray or dingy reddish, the stem and gills also changing in a similar manner. The cap is generally obtuse but sometimes umbonate. The margin is very thin and when young is incurved and sometimes

striatulate, the obscure striations being the shadowy lines of the gills showing through the membranous and almost translucent substance of the margin. In drying, the excessive moisture escapes from the center of the cap first. The margin is naked even in young plants and in this character the species differs from its near relative, the masked tricholoma. It is also smaller than that species and more highly colored when young. The naked margin is probably the character which suggested the name of the species. The typical form of the species is described as having a stuffed stem. In our plants the stem is sometimes clearly hollow. An acid odor has been ascribed to the species but no distinct odor was perceptible in our specimens. European mycologists do not appear to have given very definitely the color of the spores of this species. Professor Fries describes the spores of the species referred by him to Paxillus, tribe Lepista, as sordid, and W. G. Smith, who raised this tribe to generic rank and referred both Tricholoma nudum and T. personatum to it, says the spores are dirty white. In our plant the spores are pale flesh color and indicate a close relationship between this species and those of the pink spored series, specially those in the genus Clitopilus. But the close connection between this species and Tricholoma personatum persuades us at present to let the species remain where it has so long stood notwithstanding the peculiar spore color. The cap in our specimens is 1–3 inches broad, the stem 1–2 inches long and 2–4 lines thick.

Stevenson says of the European plant, "Not recommended as edible." Gillet says "very good" and "very delicate" but rarely used. In our trial of it we found it agreeable in flavor, digestible and harmless and have no hesitation in placing it among the edible species. Its worst defect is its scarcity.

Clitocybe amethystina (Bolt.)

AMETHYST CLITOCYBE

PLATE 106, FIG. 1–6

Pileus at first hemispheric, becoming broadly convex or nearly plane, hygrophanous, often obscurely striate on the margin when young and moist, depressed in the center or frequently umbilicate, often irregular, violaceous when moist, grayish or grayish white when dry; lamellae rather thick, subdistant, violaceous, adnate or slightly decurrent; stem slender, rigid, straight or flexuose, stuffed,

becoming hollow, paler than the moist pileus; spores globose, verrucose, .0003–.0004 of an inch broad.

The amethyst clitocybe is a small species, gregarious in its mode of growth and slightly tough. European mycologists have generally considered it as a mere form or at most a variety of Clitocybe laccata (Scop.) Fr. Berkeley and Broome instituted a new genus, Laccaria, for the reception of C. laccata and allied species with tough substance, hymenophorum confluent with the stem, and thick gills powdered with white globose spores. They remark that the amethyst colored form usually referred to Agaricus laccatus is probably distinct. Their genus has not yet been generally accepted but there is good ground for its establishment and it probably will be recognized in due time. Their remark concerning the amethyst colored form of C. laccata appears to us to be worthy of acceptance and it is therefore accepted here as a distinct species. It is easily recognizable both in its fresh and dried state from the paler and more common form usually referred to C. laccata. It is very constant in its characters and no intermediate forms occur to connect them. It is quite as good as an edible mushroom. In drying, the gills retain their violaceous color longer than the cap.

Clitocybe ochropurpurea Berk.

PURPLISH OCHER CLITOCYBE

PLATE 106, FIG. 7–11

Pileus subhemispheric, becoming convex with a decurved margin or nearly plane and slightly centrally depressed, fleshy, tough, compact, hygrophanous, purplish brown when moist, grayish or pale alutaceous when dry, unpolished; lamellae thick, distant, broad, narrower outwardly, adnate or decurrent, purple; stem variable, short or long, equal, or sometimes thicker in the middle, sometimes at each end, fibrous, solid, colored like or paler than the pileus; spores globose, white, verrucose, .0003–.0004 of an inch broad.

The purplish ocher clitocybe is related to such species as the laccate clitocybe, C. laccata, and the amethyst clitocybe, C. amethystina. From both it is easily separated by its purple gills and larger size. It is found in wet weather from July to September. It grows in open grassy places and is sometimes quite irregular in shape. Its cap is often 3–4 inches broad and its

stem 4–6 lines thick. As an edible species it is rather tough but its flavor is agreeable if well cooked and seasoned and it is harmless.

Should the proposed genus Laccaria be recognized the name of the present species would be Laccaria ochropurpurea (Berk.) and that of the preceding species would be Laccaria amethystina (Bolt.) Cke.

Russula compacta Frost

COMPACT RUSSULA

PLATE 109, FIG. 1–4

Pileus fleshy, compact, broadly convex, becoming centrally depressed or infundibuliform by the elevation of the margin, dry or slightly viscid after rain, unpolished, at first whitish slightly clouded with reddish buff, or rusty red with whitish margin, becoming entirely rusty red with age, flesh white, taste mild or slightly and tardily acrid; lamellae close, adnate or slightly rounded behind, unequal, some forked, white, changing to reddish brown where wounded and in drying; stem short, stout, firm, solid or sometimes cavernous, white, becoming stained where bruised; spores white, globose or subglobose, .0003–.00035 of an inch broad.

The compact russula is a large mushroom belonging to the Friesian section Compactae. It is allied to the European Russula mustelina Fr. from which it may be separated by its different color, which changes with age, and by its disagreeable odor in drying. The cap is usually 2–4 inches broad, but sometimes it attains a diameter of 6 inches. Its stem is short, equal, stout and firm, white when young but usually becoming colored like the cap. It is 2–2.5 inches long, 8–18 lines thick. It furnishes an abundance of agreeable food, the flesh being so thick and compact.

Russula earlei Pk.

EARLE RUSSULA

State Mus. Bul. 67, p. 24, pl. N, fig. 5–10.

The Earle russula is a very distinct and easily recognized species. No one of our other species has such distant gills combined with such small white spores. These characters in connection with its very viscid or glutinous and pale yellow or straw colored cap make it scarcely possible to confuse it with any other species. It has hitherto been found on Long Island only. It occurs in August.

Russula pectinatoides n. sp.

PECTENLIKE RUSSULA

PLATE 105, FIG. 6–10

Pileus thin, broadly convex becoming nearly plane or centrally depressed, viscid when moist, widely tuberculose striate on the margin, brownish or yellowish brown, sometimes darker in the center, flesh white, grayish white under the separable cuticle, taste mild or slightly acrid; lamellae thin, a few forked at the base, occasionally a short one, adnate, white becoming pallid; stem equal, spongy within, even, glabrous, white; spores whitish, subglobose, .00025–.0003 of an inch long.

Grassy ground in groves or pastures. The pectenlike russula is similar to Russula pectinata (Bull.) Fr. from which it differs in its mild or slightly acrid flavor, its even stem, in its flesh being grayish white under the cuticle and in its adnate gills. It is gregarious or scattered in its mode of growth and is not plentiful. It closely resembles Russula sororia Fr. in its general appearance, but may be separated from it by its milder taste.

Its cap is 1–3 inches broad; its stem is 1–2 inches long and 3–4 lines thick. It appears in July and August. It is edible but not very highly flavored.

Russula uncialis Pk.

INCH WIDE RUSSULA

PLATE 107, FIG. 7–12

Pileus thin, convex becoming expanded or centrally depressed, viscid when moist, glabrous or very minutely rivulose-granulose, red or pinkish red, the margin obscurely tuberculose striate, flesh white, taste mild; lamellae moderately close, narrowed toward the stem at which a few of them in some specimens are forked, adnate or slightly emarginate, white, the interspaces venose; stem equal, glabrous stuffed or spongy within, white or reddish; spores white, globose, rough, .0003–.00035 of an inch in diameter.

The inch wide russula belongs to the subgenus Fragiles, white spore group. It is about as large as Russula fragilis, but may be distinguished from it by its mild taste and less crowded gills. From similarly colored specimens of R. chameleontina it differs in its white spores and gills. The gills become pallid in drying.

Agaricus micromegethus Pk.

SMALL MUSHROOM

PLATE 107, FIG. 1-6

Agaricus pusillus Pk., N. Y. State Mus. Rep't 54, p. 152.

Pileus fleshy but thin, fragile, convex, becoming plane, sometimes slightly depressed in the center, dry, silky fibrillose or fibrillose-squamulose, grayish brown, darker or brown in the center, often with yellowish or ferruginous stains, flesh white or whitish, not changing color where wounded, taste and odor almond; lamellae thin, close, free, grayish, soon pinkish, finally brown; stem equal or slightly tapering upward, sometimes bulbous, stuffed or hollow, slightly fibrillose, white, the annulus slight, often evanescent; spores broadly elliptic or subglobose, .0002 of an inch long, .00016 broad.

The specimens from which this species was first described were smaller than others collected later. The caps in these now before us are 1-3 inches broad and the stems 1-2 inches long and 3-5 lines thick. The flesh is white and unchangeable when cut or wounded. It has a taste resembling that of almonds which has given origin to the local name "almond mushroom." One correspondent says that "it is the finest flavored mushroom he has ever tasted." Bruises of the cap and stem of the fresh plant sometimes assume a yellow color. The plants grow singly or in clusters. They appear from September to November, and have been found growing in both sandy and clayey soil, and in tan yards. The range is from Michigan to Massachusetts.

Boletus frostii Russell

FROST BOLETUS

PLATE 108, FIG. 1-5

Pileus convex, firm when young, becoming softer with age, glabrous, viscid, dark red becoming paler with age, flesh whitish, tinged with yellow next the tubes, taste slightly acrid; tubes concave in the young plant, becoming plane or convex, adnate, yellowish with their mouths colored like the pileus, changing to bluish green where wounded; stem equal or nearly so, solid, strongly reticulate, colored like the pileus, yellow within, often with reddish stains at the base; spores with a greenish hue when caught on white paper, subfusiform, .0005-.0006 of an inch long, .0002 broad.

The frost boletus is a very showy species. Its deep red cap and distinctly reticulate red stem are attractive to the eyes and a delight

to the mycologist. It occurs in our State on Long Island and so far as known is not found elsewhere within our limits. Its viscid cap is 2–4 inches broad and its stem about as long and 4–6 lines thick. It grows both in thin woods and in open places and occurs during July and August. According to the old rule, which pronounced all species of which the broken flesh assumed a blue color to be unfit for food and dangerous, this species should be rejected. But this rule must have its exceptions. I have eaten of this boletus without harm and one of my correspondents writes that he has eaten four caps of it at a meal and considers it an excellent species.

Boletus rugosiceps Pk.

RUGOSE CAP BOLETUS

State Mus. Bul. 94, p. 20, pl. Q, fig. 6–10.

The rugose cap boletus is well marked by its yellowish ochraceous cap which is irregularly uneven by unequal and variously shaped pits or depressions in its surface. It is sometimes slightly tinged with red or orange and occasionally embellished with small areolae formed by cracks in the surface. The surface is viscid and shining when moist and the flesh is white or whitish. The tubes are at first closed but they soon open, are minute, round and yellow, becoming darker with age. The stem is solid and firm in texture, often marked with elevated longitudinal lines or ridges and dotted with numerous points which are variable in color, being either pallid, brownish or yellowish. The cap is 1–3 inches broad, the stem 2–4 inches long and 4–8 lines thick. The plants grow in thin woods and may be found in August. They have been found on Long Island but not in other parts of the State. In preparing them for the table it is well to peel away the cuticle and the tubes and discard the stem.

NEW YORK SPECIES OF HYGROPHORUS

Hygrophorus Fr.

Hymenophorum continuous with the stem, descending unchanged into the trama; lamellae acute on the edge, clothed with a hymenium changeable into a waxy mass, not membranaceous; spores globose elliptic or ovoid, white.

Terrestrial putrescent fungi with a viscid or moist pileus.

The waxy character of the hymenium is the chief distinguishing character of the genus. The lamellae are usually thick, distant or subdistant, and their hymenial surfaces somewhat separable from

the trama. Many species with decurrent gills are similar in appearance to species of Clitocybe, but such species may generally be distinguished by their distant lamellae and their viscid pileus and stem. The genus was divided by Fries into three tribes or subgenera which have not yet been accepted as genera but they probably will be in due time. The following synoptic key indicates the prominent characters that may be employed in their separation.

KEY TO THE SUBGENERA

	Stem solid or stuffed	1
	Stem hollow	Hygrocybe
1	Pileus moist, not viscid	Camarophyllus
1	Pileus and stem viscid	Limacium

Limacium Fr.

Universal veil viscid with a partial floccose veil sometimes forming a ring or attached to the margin of the pileus; lamellae adnate or decurrent; stem clothed with squamules or more often scabrous punctate at the top (or sometimes glabrous).

In this subgenus the pileus and stem are normally viscid but in Hygrophorus purpurascens Fr. and H. capreolarius Kalchb. they soon become dry. The stem is usually solid or stuffed, but in H. eburneus Fr. and H. hypothejus Fr. it often becomes hollow. H. pudorinus Fr. is described as having no veil, but the pileus and stem are viscid. Perhaps the "velum nullum" has reference to the partial floccose veil only. There are several species in which the stem is neither squamulose nor scabrous punctate at the top. In other respects they agree with the description of this subgenus. They are H. fuligineus Frost, H. flavodiscus Frost, H. speciosus Pk., H. subviolaceus Pk., H. hypothejus Fr. and H. lividoalbus Fr. This might justify the formation of a new subgenus for their reception, but since Fries himself has placed several similar European species in his subgenus Limacium, thus practically recognizing this additional character, it has seemed better to extend the characters of the subgenus, as Fries has done in fact though not in words, than to found another subgenus on such a slight difference.

KEY TO THE SPECIES

	Pileus white, or white with the center yellowish or brownish	1
	Pileus pinkish, violaceous or red or purple with paler margin	7
	Pileus livid white, cinereous or brown	11
1	Margin of pileus with yellow floccose points	chrysodon
1	Margin of the pileus naked	2

2 Stem hollow when mature.......................................3
2 Stem solid or stuffed, not hollow when mature....................4
3 Lamellae white.......................................eburneus
3 Lamellae yellow or yellowish.............................hypothejus
4 Lamellae becoming brownish with age or in drying....................5
4 Lamellae persistently white or whitish..............................6
5 Pileus slightly virgate with innate fibrils......................virgatulus
5 Pileus not fibrillose...laurae
6 Stem scabrous punctate at the top.....................rubropunctus
6 Stem glabrous at the top...................................flavodiscus
7 Pileus purple or with purple squamules in the center..................8
7 Pileus some other color...9
8 Pileus uniformly colored...................................capreolarius
8 Pileus with purple squamules in the center.............purpurascens
9 Stem scabrous punctate at the top...........................pudorinus
9 Stem glabrous, naked at the top.....................................10
10 Pileus bright red, fading to yellow on the margin...........speciosus
10 Pileus pale violaceous.......................................subviolaceus
11 Stem naked at the top...12
11 Stem not naked at the top...13
12 Stem solid...fuligineus
12 Stem stuffed..lividoalbus
13 Stem squamulose at the top.....................................limacinus
13 Stem white floccose at the top................................fuscoalbus

Hygrophorus chrysodon (Batsch) Fr.

GOLDEN TOOTH HYGROPHORUS

Pileus convex or nearly plane, viscid when moist, shining when dry, white with yellow particles or flocci on the margin and sometimes in the center also, flesh white; lamellae distant, decurrent, white, sometimes yellowish on the edge; stem equal or nearly so, stuffed, white with yellow floccose points at the top; spores elliptic, .0003–.00035 of an inch long, .00016–.0002 broad.

Pileus 1.5–3 inches broad; stem 1.5–2.5 inches long, 3–5 lines thick.

Woods and open places. Albany, Columbia and Ulster counties. Not common. September and October.

A beautiful mushroom easily known by the yellow ornamentation of the margin of the pileus, the upper part of the stem and sometimes the edge of the lamellae.

Hygrophorus eburneus (Bull.) Fr.

IVORY HYGROPHORUS

Pileus convex or nearly plane, viscid when moist, slightly pubescent on the margin when young, white, flesh white; lamellae distant,

decurrent, white; stem equal or narrowed at the base, straight or flexuous, stuffed or hollow, viscid, white with white points or squamules at the top; spores subelliptic, .00024–.0003 of an inch long, .0002–.00024 broad.

Pileus 1–2 inches broad; stem 1.5–3 inches long, 2–4 lines thick.

Thin woods and open places. Sometimes cespitose. Lake Mohonk, Ulster co. September and October. It may be distinguished from its near allies by its hollow stem. It is said to be edible but I have not tried it. The viscidity of the stem makes it difficult to pluck from its place of growth and unpleasant to handle.

Hygrophorus virgatulus Pk.

BLACK LINED HYGROPHORUS

State Mus. Rep't 26. 1874. p. 64.

Pileus convex or nearly plane, viscid when moist, minutely streaked with innate blackish fibrils, whitish with a brownish center, flesh white; lamellae distant, arcuate, decurrent, white becoming brownish in drying; stem equal or tapering downward, solid, viscid, white with a few small white floccose scales at the top; spores .0003–.00035 of an inch long, .00016–.0002 broad.

Pileus 1–2 inches broad; stem 2–3 inches long, 2–3 lines thick.

Woods. Rensselaer county. October. Very rare. The specimens here described were found in 1872 but no specimens of this species have since been found. The species is closely related to H. laurae from which it may be separated by its smaller size, more dingy color of the pileus with its innate fibrils and by its more soft floccose scales at the top of the stem.

Hygrophorus laurae Morg.

LAURA HYGROPHORUS

Jour. Cinn. Soc. Nat. Sci. 6. 1883. p. 180.

Pileus fleshy, convex, umbonate, becoming expanded and depressed, more or less irregular, glutinous, white with a reddish or brownish tinge, specially on the disk, flesh white; lamellae unequal, adnate or decurrent, distant, white; stem more or less curved or crooked, often tapering downward, solid, yellowish white, the apex scabrous with scaly points; spores elliptic, apiculate, .0003 of an inch long, .0002 broad.

Pileus 2–4 inches broad; stem 2–4 inches long, 3–6 lines thick.

Woods and open places. Common. August and September. Single, gregarious or cespitose.

Var. unicolor Pk. Pileus wholly white or only faintly tinged with yellow. Warren county. September. Edible. In this variety and in the typical form both pileus and lamellae become darker colored with age or in drying, but in the lamellae the change is more pronounced than in the pileus.

Var. decipiens Pk. Pileus thin, white with a dingy yellow or smoky brown spot in the center; lamellae subdistant, stem long, slender, white; pileus and stem not changing color with age or in drying, lamellae changing color slightly. Cespitose; borders of woods. Hamilton county. September. Edible.

More slender than the typical form and differing specially in the persistent colors of the pileus and lamellae. Closely related to the next following species.

(Hygrophorus rubropunctus n. nom.

RED DOTTED HYGROPHORUS

(**Hygrophorus glutinosus** Pk.)

State Mus. Bul. 54. 1902. p. 950.

Pileus fleshy, firm, convex, glutinous, white, sometimes tinged with yellow by the drying of the gluten, involute on the margin, flesh white; lamellae subdistant, adnate, white; stem equal, solid, white, floccose tomentose below the glutinous annulus, studded above with drops of moisture which in drying form reddish glandular dots; spores elliptic, .0003–.0004 of an inch long, .0002–.00024 broad.

Pileus 1–2 inches broad; stem 1–1.5 inches long, 3–4 lines thick.

Open places. Warren county. September. Rare. In the fresh plant the lower part of the stem appears to be coated with tomentum smeared with gluten, but in the dried plant the gluten assumes an orange-yellow or bright straw color and the tomentum disappears. The species differs from H. laurae Morg. in its white pileus, persistently white lamellae, reddish dots at the top of the stem and in the tomentum of the lower part of the stem. Agaricus glutinosus Bull., in its transfer to the genus Hygrophorus to which it belongs, was consigned to synonymy, therefore according to the rule "once a synonym always a synonym" it becomes necessary to change the name Hygrophorus glutinosus Pk. This has been done by substituting for it the name Hygro-

phorus rubropunctus which has reference to the red dots at the top of the stem.

Hygrophorus flavodiscus Frost

YELLOW DISKED HYGROPHORUS

State Mus. Rep't 35. 1884. p. 134; State Mus. Mem. 3, p. 145, pl. 50, fig. 1–6.

Pileus fleshy, convex or nearly plane, very viscid or glutinous, white, pale yellow or reddish yellow in the center, flesh white; lamellae adnate or decurrent, subdistant, white, sometimes with a slight flesh-colored tint; stem nearly equal, solid, very viscid or glutinous, white at the top, white or yellowish below; spores elliptic, .00025–.0003 of an inch long, .00016–.0002 broad.

Pileus 1–3 inches broad; stem 1–3 inches long, 3–6 lines thick.

Pine woods. Albany county. October. Rare. Edible. This is an excellent edible species, tender and agreeable in flavor. It is well to strip off the viscid pellicle with its adhering dirt and leaves before cooking. The species differs but slightly except in color from H. fuligineus Frost with which it sometimes grows.

Hygrophorus capreolarius Kalchb.

CAPREOLAR HYGROPHORUS

Pileus fleshy, convex becoming plane or centrally depressed, subviscid but soon dry, virgate with innate darker fibrils and punctate squamulose in the center, purplish red, flesh reddish; lamellae narrowed toward each end, distant, adnate or decurrent, purplish with a slight cinnamon tint; stem nearly equal, solid, striate or reticulate with obscure fibrils, purplish brown; spores .00024–.0003 of an inch long, .0002–.00024 broad.

Pileus 1–3 inches broad; stem 1–3 inches long, 3–6 lines thick.

Gregarious or cespitose. Woods, mostly under coniferous trees. Essex county. September.

This was published by Kalchbrenner as a variety of H. erubescens Fr. but in the *Sylloge* it is given as a distinct species and most mycologists recognize it as such at the present time. The spore dimensions given above are from spores of our American specimens.

Hygrophorus purpurascens (A. & S.) Fr.

PURPLISH HYGROPHORUS

Pileus fleshy, convex becoming plane, slightly viscid, soon dry, whitish, variegated in the center with purplish red spots or appressed

squamules; lamellae subdistant, adnate or slightly decurrent, whitish; stem equal, solid, white, roughened by purplish squamules, sometimes with slight traces of a veil near the top; spores .00024 of an inch long, .00016 broad.

Pileus 1.5–3 inches broad; stem 1–2 inches long, 3–6 lines thick.

Gregarious, under pine trees. Albany county. October. Very rare. Found but once. Our specimens differ slightly from the typical form, the pileus being fibrillose rather than squamulose and the lamellae are whitish, not purplish. There is a partial webby veil which forms a slight but mostly evanescent annulus. This species and H. capreolarius are less viscid than the other members of this subgenus here described. The spore dimensions are from American specimens.

Hygrophorus pudorinus Fr.

BLUSHING HYGROPHORUS

State Mus. Bul. 67, p. 41, pl. 83, fig. 1–6.

Pileus fleshy, firm, convex becoming nearly plane, glabrous, viscid when moist, pinkish buff or pale flesh color, flesh white, taste mild; lamellae distant, adnate or decurrent, white; stem equal or pointed at the base, solid, white or whitish, with white points at the top; spores elliptic, .0003–.0004 of an inch long, .00016–.0002 broad.

Pileus 2–4 inches broad; stem 2–5 inches long, 6–10 lines thick.

Gregarious or cespitose. Commonly under spruce or balsam fir trees. Essex county. September. Edible. This is a beautiful species, generally free from the attacks of insect larvae, attractive in appearance and of excellent flavor. It is a first-class edible mushroom. The plant referred to Hygrophorus queletii Bres. in State Museum Report 42, page 23 is now believed to be only a form of this species and it is therefore omitted.

Hygrophorus speciosus Pk.

SHOWY HYGROPHORUS

State Mus. Rep't 29, 1878; p. 43, pl. 2, fig. 1–5. State Mus. Mem. 3, p. 148, pl. 51, fig. 21–28.

Pileus ovate or subconic becoming broadly convex or nearly plane, often with a small blunt or acute umbo, glabrous, very viscid or glutinous, bright red or scarlet when young, or red in the center, yellow on the margin, sometimes fading and becoming wholly yellow, flesh white, pale yellow under the separable pellicle; lamellae dis-

tant, decurrent, white or slightly tinged with yellow; stem rather long, nearly equal, solid, viscid, sometimes slightly fibrillose, whitish or yellowish; spores elliptic, .0003 of an inch long, .0002 broad.

Pileus 1–2 inches broad; stem 2–4 inches long, 2–4 lines thick.

Gregarious. Under or near tamarack trees. Albany, Essex and Warren counties. September and October. Edible.

This is a beautiful mushroom but its bright colors fade with age and in drying. The bright red or scarlet usually persists longest in the center. Sometimes the umbo alone remains red. The species is closely related to the European H. aureus Arrh. from which it differs in its place of growth, its solid stem, the absence of any tawny hues and of any vestiges of an annulus. H. bresadolae Quel. and H. lucorum Kalchb. are also closely related European species from which our plant differs in its solid stem and the absence of any annulus. No red color is attributed in the descriptions, to either of the three species mentioned, but H. aureus is sometimes figured with a red center to the pileus.

Hygrophorus subviolaceus Pk.

VIOLET HYGROPHORUS

State Mus. Rep't 53. 1899. p. 842, pl. C, fig. 11–15.

Pileus firm, hemispheric, becoming convex, glabrous, viscid, violaceous when fresh and moist, paler or grayish when dry, flesh white; lamellae arcuate, decurrent, distant, pale violaceous; stem equal or tapering downward, solid, glabrous, white; spores subglobose or broadly elliptic, .00024–.0003 of an inch long, .0002–.00024 broad.

Pileus 1–1.5 inches broad; stem, 1–1.5 inches long, 2–4 lines thick.

Damp mucky ground in swamps. Meadowdale, Albany co. October.

This species has been found but once. It is evidently very rare. In drying the specimens become blackish or brown. It is related to H. lacmus Fr. but differs from it in its solid stem, in the color of the lamellae and in having no papilla or umbo on the pileus.

Hygrophorus fuligineus Frost

SOOTY HYGROPHORUS

State Mus. Mem. 3, p. 146, pl. 50, fig. 7–12.

Pileus convex or nearly plane, glabrous, very viscid or glutinous, grayish brown or fuliginous, often darker or almost black in the center; lamellae subdistant, adnate or decurrent, white; stem

equal, solid, viscid or glutinous, white or whitish; spores elliptic, .0003–.00035 of an inch long, .0002 broad.

Pileus 1–4 inches broad; stem 2–4 inches long, 4–8 lines thick.

Pine woods. Albany county. October and November. Edible. Often growing in company with H. flavodiscus and equally esteemed as an edible mushroom. Both occur late in the season. The stem is sometimes brownish at the base.

Hygrophorus limacinus (Scop.) Fr.

SLIMY HYGROPHORUS

Pileus fleshy, convex becoming nearly plane, glabrous, viscid, brownish or smoky brown in the center, paler on the margin; lamellae rather thin, subdistant, adnate or decurrent, grayish white; stem equal, firm, solid, viscid, fibrillose striate, squamulose at the top, colored like the pileus toward the base, paler above; spores .0005 of an inch long, .0003 broad.

Pileus 1.5–2.5 inches broad; stem 1–2 inches long, 4–6 lines thick.

Grassy places. Rensselaer county. September. Rare. Found but once.

Hygrophorus fuscoalbus (Lasch.) Fr.

GRAYISH BROWN HYGROPHORUS

Pileus convex becoming plane, even, glabrous, viscose, brownish becoming cinereous, paler on the margin; lamellae rather thick, broad, subdistant, adnate or decurrent, white; stem equal, solid, dry, white floccose at the top, whitish or brownish; spores .0003–.0004 of an inch long, .0002–.00024 broad.

Pileus 1–2 inches broad; stem 2–3 inches long, 1.5–3 lines thick.

Woods. Essex county. September. Rare. The typical form of this species is said to have a subannular floccose veil, a character which is not shown by our specimens. European authors do not agree in the dimensions ascribed to the spores of this species. In our specimens the dimensions of the spores agree with those given in *Sylloge*.

Hygrophorus hypothejus Fr.

SULFUR TINTED HYGROPHORUS

Pileus fleshy but thin, convex becoming plane or centrally depressed, even, virgate, glutinous, variable in color, grayish olive, yellowish olive or brownish, paler after the gluten disappears, flesh

thin with a slight yellow tinge; lamellae distant, decurrent, yellow, or whitish becoming yellowish; stem equal, stuffed or hollow, viscid, paler than the pileus, the partial floccose veil imperfectly annular, soon disappearing; spores .0003–.0004 of an inch long, .00016–.0002 broad.

Pileus 1–2 inches broad; stem 2–3 inches long, 3–5 lines thick.

Woods. Essex county. September. Rare. This species may be distinguished from its nearest relatives by its yellowish lamellae. It is more common southward where it occurs late in the season, growing specially in pine woods.

Hygrophorus lividoalbus Fr.

LIVID WHITE HYGROPHORUS

Pileus thin, convex or nearly plane, often irregular or wavy, even, glabrous, viscid, pallid or livid, naked on the margin; lamellae distant, adnate or slightly decurrent, white; stem slender, nearly equal, glabrous, stuffed, more or less flexuous, whitish; spores subglobose, .00024–.0003 of an inch long, .0002–.00024 broad.

Pileus 1–2 inches broad; stem 1.5–2.5 inches long, 2–3 lines thick.

Woods. Onondaga and Ulster counties. September. Rare. Our specimens do not fully agree with the description of the species in respect to the spore character which is given above, the European plant having larger and more elliptic spores. Further observation may show them to be closely related but distinct species.

Camarophyllus Fr.

Veil none; pileus firm, opaque, moist in rainy weather, not viscose; lamellae distant, arcuate; stem even, glabrous or fibrillose, not punctate scabrous.

The absence of a viscid pileus and of a hollow stem are decisive characters of the subgenus. In wet weather the pileus is only moist, not viscid. The stem is usually solid or stuffed. In a single species, Hygrophorus peckianus Howe, it sometimes becomes hollow.

KEY TO THE SPECIES

Pileus white or whitish 1
Pileus brown, grayish brown or blackish brown 3
Pileus neither white nor brown 6
1 Pileus more than 1 inch broad .... virgineus
1 Pileus usually less than 1 inch broad 2
2 Stem 1–2 lines thick .... borealis

2 Stem more than 2 lines thick .... pratensis
3 Pileus less than 1 inch broad .... peckianus
3 Pileus more than 1 inch broad 4
4 Pileus glabrous 5
4 Pileus not glabrous .... metapodius
5 Pileus blackish brown .... burnhami
5 Pileus grayish brown .... basidiosus
6 Pileus glabrous .... pratensis
6 Pileus not glabrous .... subrufescens

Hygrophorus virgineus (Wulf.) Fr.

WHITE HYGROPHORUS

State Mus. Mem. 3, p. 150, pl. 52, fig. 8–12.

Pileus fleshy, convex, often becoming plane or centrally depressed, sometimes irregular or wavy on the thin margin, moist, white, flesh white, taste mild; lamellae thick, distant, decurrent, white; stem firm, smooth, solid, equal or tapering downward, white; spores elliptic, .00024–.0003 of an inch long, .0002 broad.

Pileus 1–3 inches broad; stem 1–2 inches long, 3–5 lines thick.

It occurs in grassy places in wet weather and may be found from July to October. Albany, Essex and Rensselaer counties. In the European plant the surface of the pileus is said to become floccose when dry and sometimes to crack into small areas, but these characters have not been observed by us in the American plant. It is edible.

Hygrophorus borealis Pk.

NORTHERN HYGROPHORUS

State Mus. Rep't 26. 1874. Bot. ed. p. 64.

Pileus thin, convex or nearly plane, glabrous, moist, even, sometimes striatulate on the margin; lamellae distant, arcuate, decurrent, white; stem slender, firm, glabrous, straight or flexuous, equal or tapering downward, stuffed or solid, white; spores elliptic, .0003–.00035 of an inch long, .0002–.00024 broad.

Pileus 8–12 lines broad; stem 1–2 inches long, 1–2 lines thick.

Damp or moist ground in woods and swamps, occasionally in pastures. Common in hilly and mountainous regions. July to October. This small white species is closely allied to H. niveus (Scop.) Fr. from which it may be separated by its pileus which is neither viscid nor umbilicate.

Hygrophorus pratensis (Pers.) Fr.

MEADOW HYGROPHORUS

State Mus. Rep't 48, p. 279, pl. 28, fig. 11–17.

Pileus compact, convex, turbinate or nearly plane, often irregular, glabrous, thin on the margin, variable in color, tawny, reddish, buff, cinereous or whitish, flesh white or whitish, taste mild; lamellae thick, distant, decurrent, whitish or yellowish, the interspaces often veiny, stem short, even, glabrous, solid or stuffed, equal or narrowed downward, white or tinged with the color of the pileus; spores .00024–.0003 of an inch long, .00016–.0002 broad.

Pileus 1–3 inches broad; stem 2–3 inches long, 4–6 lines thick.

Scattered, gregarious or cespitose; growing in woods, pastures and grassy places. Common. July to September.

Several varieties of this variable species have been recognized. The names given them are mostly derived from their color. Var. albus. Whole plant white or whitish. Var. cinereus. Whole plant cinereous or the stem only whitish. Var. pallidus. Plant ochraceous white. The plants are edible when cooked.

Hygrophorus peckianus Howe

PECKIAN HYGROPHORUS

Bul. Torrey Bot. Club 5. 1874. p. 43.

Pileus rather thin but firm, convex or slightly depressed in the center, glabrous, hygrophanous, sooty brown when moist, paler or buff brown when dry, the margin often decurved and wavy; lamellae subdistant, thick, arcuate, decurrent, pallid, becoming darker with age; stem slender, glabrous, flexuous, stuffed, sometimes becoming hollow, often narrowed toward the base, colored like the pileus; spores subglobose, .0002–.00024 of an inch long.

Pileus 5–10 lines broad; stem 1.5–2 inches long, 1–2 lines thick.

Gregarious or cespitose. Growing under ferns. Hamilton county. August. The fresh plant emits a peculiar, indescribable odor. It is closely related to the European H. foetens Phil. and may be specifically the same. Its name, however, antedates that of the European plant.

Hygrophorus burnhami n. sp.

BURNHAM HYGROPHORUS

Pileus fleshy, broadly conic becoming convex or nearly plane, moist in wet weather, glabrous or slightly and obscurely innately

fibrillose on the margin, blackish brown, flesh white; lamellae narrow, sometimes forked, subdistant, adnate or slightly decurrent, white; stem equal, sometimes pointed or abruptly narrowed at the base, fibrillose striate, solid, whitish becoming tinged with the color of the pileus, white within and white tomentose at the base; spores elliptic, .0003–.0004 of an inch long, .0002–.00024 broad.

Pileus 1–2 inches broad; stem 1.5–3 inches long, 4–6 lines thick.

Gregarious. Growing in mixed woods. West Fort Ann, Washington co. October. S. H. Burnham.

This species is a near ally of H. caprinus (Scop.) Fr. from which it may be separated by its more glabrous pileus, more narrow and closer lamellae, which also are less decurrent. The stem is paler than the pileus and generally slightly radicated at the base and there covered with a white mycelioid tomentum. The lamellae are about 1 line broad.

Hygrophorus metapodius Fr.

CHANGED STEM HYGROPHORUS

Pileus compact, convex becoming nearly plane, often irregular, soon silky and squamulose, brown or grayish brown, flesh thick; lamellae thick, distant, adnate or somewhat decurrent, broadly emarginate, grayish white; stem unequal, sometimes narrowed toward the base, sometimes ventricose, stuffed, glabrous, cinereous, reddish within; spores .0003 of an inch long, .0002 broad.

Pileus 1.5–2 inches broad; stem 1–2 inches long, 3–5 lines thick.

Woods or groves. Ulster county. September. Rare. This species has been found but once. The specimens differ from the typical form in the flesh not becoming red where wounded and no odor was observed at the time of collection.

Hygrophorus basidiosus n. comb.

GRAYISH BROWN HYGROPHORUS

Clitocybe basidiosa Pk. State Mus. Bul. 2. 1887. p. 5.

Pileus rather thin, convex becoming nearly plane or centrally depressed, sometimes umbilicate, glabrous, hygrophanous, grayish brown and striatulate on the margin when moist, grayish white when dry, flesh whitish; lamellae subarcuate, thick, distant, adnate or slightly decurrent, whitish with a violaceous tint; stem equal or slightly thickened at the top, glabrous, firm, solid, whitish or

pallid; spores subglobose, .00016–.0002 of an inch long, basidia .0024 of an inch long, bearing spicules .0003 of an inch long.

Pileus 1–1.5 inches broad; stem 1–2 inches long, 1–2 lines thick.

Woods and swamps. Albany and Rensselaer counties. August.

This species was formerly taken to belong to the genus Clitocybe, but it now appears to be a better Hygrophorus than Clitocybe. It is remarkable for the elongated basidia and sterigmata of the hymenium. It is rare but easily recognized by the peculiar grayish brown hue of the moist plant and the slight violaceous hue of the lamellae.

Hygrophorus subrufescens Pk.

REDDISH HYGROPHORUS

State Mus. Bul. 67. 1903. p. 23, pl. M, fig. 1–6.

Pileus thin on the margin, convex or nearly plane, dry, minutely floccose or squamulose, pale pink or grayish red, flesh whitish, faintly tinged with pink, taste mild; lamellae subdistant, decurrent, whitish; stem equal or nearly so, flexuous, glabrous, solid or stuffed, white; spores elliptic, .0003 of an inch long, .0002 broad.

Pileus 1–1.5 inches broad; stem 1.5–3 inches long, 2–4 lines thick.

Fallen leaves in woods. Suffolk county. August. Rare. Found but once.

Hygrocybe Fr.

Veil none; pileus viscid when moist, shining when dry, rarely floccose scaly; lamellae soft; stem hollow, soft, glabrous.

The whole fungus is slender, watery, fragile; many of the species are brightly colored.

A few species without a viscid pileus are included in this subgenus because of their fragility, bright colors and hollow stems. By these characters they may be separated from the subgenus Camarophyllus.

KEY TO THE SPECIES

	Pileus not viscid	1
	Pileus viscid	5
1	Lamellae decurrent	2
1	Lamellae not decurrent	3
2	Pileus glabrous, pale yellow	parvulus
2	Pileus usually squamulose, red, rarely yellow	cantharellus
3	Pileus brown, sometimes tinged with green or yellow	immutabilis
3	Pileus not brown	4
4	Pileus pale yellow	parvulus
4	Pileus golden yellow	marginatus
4	Pileus usually red or orange, rarely yellow	miniatus
5	Stem not viscid	6

5 Stem viscid 10
    6 Pileus some shade of red 7
    6 Pileus not at all red .... ceraceus
7 Pileus grayish red or tawny red .... laricinus
7 Pileus bright red, orange or scarlet 8
    8 Pileus acutely conic .... conicus
    8 Pileus not acutely conic 9
9 Stem red with a white base .... puniceus
9 Stem red with a yellow base .... coccineus
    10 Stem and pileus with greenish slime when young 11
    10 Stem and pileus not greenish 12
11 Lamellae decurrent .... peckii
11 Lamellae adnate .... psittacinus
    12 Pileus white .... purus
    12 Pileus brown .... luridus
    12 Pileus neither white nor brown 13
13 Pileus less than 6 lines broad .... minutulus
13 Pileus more than 6 lines broad 14
    14 Pileus umbilicate .... nitidus
    14 Pileus not umbilicate 15
15 Lamellae adnexed .... chlorophanus
15 Lamellae adnate or decurrent .... laetus

Hygrophorus parvulus Pk.

SMALL HYGROPHORUS

State Mus. Rep't 28. 1876. Bot. ed. p. 50, pl. 1, fig. 20–24.

Pileus thin, hemispheric or convex, glabrous, striatulate on the margin when moist, pale yellow; lamellae subdistant, arcuate, adnate or decurrent, whitish or pale yellow; stem equal, glabrous, hollow, yellow or pale yellow; spores elliptic, .00024–.0003 of an inch long, .00016–.0002 broad.

Pileus 3–6 lines broad; stem 1–1.5 inches long, 1–1.5 lines thick.

Woods and open places. Common. August.

A noticeable feature in this species is found in the stem which is often more highly colored than the pileus. It sometimes grows under brakes, Pteris aquilina L.

Hygrophorus cantharellus Schw.

CHANTARELLE HYGROPHORUS

State Mus. Rep't 54. 1901. p. 175, pl. 76, fig. 8–20.

Pileus thin, convex, sometimes umbilicate, glabrous or minutely squamulose, red, orange or yellow; lamellae rather broad, distant, arcuate, decurrent, whitish or yellowish, sometimes tinged with red; stem slender, fragile, glabrous, stuffed or hollow, red, orange or

yellow; spores elliptic, .0003–.0004 of an inch long, .0002–.00024 broad.

Pileus 6–12 lines broad; stem 1–3 inches long, 1–2 lines thick.

Gregarious. Damp soil in woods or open places. Common. June to August. Edible.

Var. roseus Pk. Margin of the pileus wavy or lobed, the lobes often crowded or overlapping.

Var. flavipes Pk. Pileus red or orange, stem yellow.

Var. flaviceps Pk. Pileus yellow, stem red or reddish.

Var. flava Pk. Pileus and stem pale yellow.

Hygrophorus immutabilis Pk.

UNCHANGEABLE HYGROPHORUS

State Mus. Rep't 51. 1898. p. 292.

Pileus thin, conic or convex, umbonate, often striate when dry, greenish brown or yellowish brown, not changing color in drying; lamellae subdistant, whitish or yellowish; stem slender, glabrous, hollow, yellow; spores elliptic, .0004–.0005 of an inch long, .00024–.00028 broad.

Pileus 8–12 lines broad; stem 1–2 inches long, 1.5–2 lines thick.

Dry sandy soil in bushy places. Essex county. August. Rare. Found but once.

Hygrophorus marginatus Pk.

MARGINED HYGROPHORUS

State Mus. Rep't 28. 1876. Bot. ed. p. 50.

Pileus thin, fragile, convex, subcampanulate or nearly plane, often irregular, sometimes broadly umbonate, glabrous, shining, striatulate on the margin, bright golden yellow; lamellae rather broad, subdistant, ventricose, emarginate, adnexed, yellow, sometimes becoming orange or vermilion on the edge, interspaces venose; stem fragile, glabrous, often flexuous, compressed or irregular, hollow, pale yellow; spores broadly elliptic, .00024–.0003 of an inch long, .0002–.00024 broad.

Pileus 10–18 lines broad; stem 1–2 inches long, 1–2 lines thick.

Woods. Essex, Fulton and Rensselaer counties. August.

This beautifully colored hygrophorus resembles the European H. obrusseus Fr. in color, but it differs in its smaller size, more subglobose spores and the red color often assumed by the edge of the lamellae. This last character is suggestive of the specific name. It is so fragile that care is necessary to avoid breaking the

specimens when collecting them. Specimens have been received from correspondents that are said to be viscid when fresh and moist, but when received were not distinguishable from our specimens of this species. It is therefore probable that in wet weather this plant may be found viscid.

Hygrophorus miniatus Fr.

VERMILION HYGROPHORUS

State Mus. Rep't 48. 1896. Bot. ed. p. 182, pl. 28, fig. 1-10.

Pileus thin, fragile, convex becoming nearly plane, glabrous or minutely squamulose, often umbilicate, deep red or sometimes yellow; lamellae distant, adnate, yellow, often tinged with red or rarely wholly red; stem slender, glabrous, equal, stuffed or hollow, polished, colored like or a little paler than the pileus; spores .0003 of an inch long, .0002 broad.

Pileus .5-2 inches broad; stem 1-3 inches long, 1-2 lines thick.

Scattered, gregarious or cespitose. Woods and swamps, among mosses and fallen leaves or on bare ground. Common. June to September. Edible.

Var. subluteus Pk. [var. lutescens Pk. State Mus. Rep't 48, Bot. ed. p. 183]. Pileus yellow or reddish yellow; lamellae and stem yellow.

Var. congelatus Pk. [Hygrophorus congelatus Pk. State Mus. Rep't 23, p. 114]. Pileus small, convex, dingy red, glabrous; lamellae subemarginate, red.

Var. sphagnophilus Pk. Pileus subconic or broadly convex, sometimes centrally depressed, glabrous, red or orange; stem colored like or a little paler than the pileus, white or yellow at the base. Growing among peat mosses in bogs. More fragile than the typical form.

The vermilion hygrophorus is a very variable but beautiful species. Unfortunately its colors are apt to fade and its beauty to be lost in drying.

Hygrophorus ceraceus (Wulf.) Fr.

WAXY HYGROPHORUS

Pileus thin, fragile, convex becoming plane, striatulate, viscid, shining, waxy yellow; lamellae broad, almost triangular, distant, adnate or slightly decurrent, pale yellow; stem sometimes unequal and flexuous, hollow, shining, waxy yellow; spores elliptic, .0003 of an inch long, .00016-.0002 broad.

Pileus about 1 inch broad; stem 1–2 inches long, 1–2 lines thick.

Gregarious. Mossy ground or grassy places. Albany, Essex and Ulster counties. September. A small species having very broad lamellae, which are scarcely decurrent. Its waxy yellow color is suggestive of the specific name.

Hygrophorus laricinus Pk.

LARCH HYGROPHORUS

State Mus. Mem. 3. 1900. p. 146, pl. 51, fig. 1–12.

Pileus thin, convex becoming plane, viscid when moist, grayish red, rusty red or tawny red, sometimes white or yellow on the margin, flesh white, slightly tinged with yellow under the cuticle, taste slightly disagreeable; lamellae distant, adnate or slightly decurrent, whitish; stem equal, firm, hollow, white; spores elliptic, .00024–.0003 of an inch long, .00016–.0002 broad.

Pileus 6–12 lines broad; stem 1–2 inches long, 2–3 lines thick.

Gregarious under tamarack trees. Warren county. October. Rare. Edible. Found but once. The flesh is tender and of good flavor when cooked.

Hygrophorus conicus (Scop.) Fr.

CONIC HYGROPHORUS

Pileus thin, conic, acute or subacute, fragile, glabrous or fibrillose, viscid when moist, shining when dry, often lobed on the margin, red, scarlet, orange or yellow; lamellae thin, rather close, ventricose, narrowed behind, almost free, commonly yellowish; stem equal, fibrously striate, hollow, yellow; spores broadly elliptic, .0004–.0005 of an inch long, .00024–.0003 broad.

Pileus 6–10 lines high and broad; stem 1–4 inches long, 1–2 lines thick.

Woods and in mossy or grassy places. Common. June to September. This species is easily recognized by the conic shape of the pileus which usually terminates in an acute point. Wounded places in the fresh plant are apt to turn black and the whole plant usually turns black in drying. The color of the pileus is variable and Gillet has published several varieties founded on this character. The viscidity of the cap is slight.

Hygrophorus puniceus Fr.

RED HYGROPHORUS

State Mus. Mem. 3. p. 149, pl. 52, fig. 1–7.

Pileus thin, fragile, broadly conic or campanulate, becoming nearly plane, often wavy or lobed on the margin, glabrous, viscid, bright red, paler when old; lamellae broad, thick, distant, slightly adnexed, yellow, often reddish; stem equal or slightly ventricose, hollow, glabrous, yellow or red and yellow, white at the base; spores elliptic, .0003–.0004 of an inch long, .0002 broad.

Pileus 1–3 inches broad; stem 2–3 inches long, 4–6 lines thick.

Damp or mossy places in woods or open ground. Albany and Rensselaer counties and the Adirondack region. Not common. August and September. Edible.

A conspicuous but very tender and fragile mushroom, often larger than our other bright red species of this genus.

Hygrophorus coccineus (Schaeff.) Fr.

SCARLET HYGROPHORUS

Pileus thin, fragile, convex becoming plane, viscid, glabrous, bright red becoming pale, flesh red; lamellae distant, adnate or furnished with a decurrent tooth, pale yellow or reddish, the interspaces veiny; stem terete or compressed, glabrous, hollow, crimson red above, yellow at the base; spores .0003–.0004 of an inch long, .0002–.00024 broad.

Pileus 1–2 inches broad; stem 1–2 inches long, 1–2 lines thick.

Pastures and mossy meadows. Albany, Ulster and Essex counties. September and October. Not common.

Hygrophorus peckii Atk.

PECK HYGROPHORUS

Jour. Myc. 8. 1902. p. 114.

Pileus thin, fragile, convex becoming nearly plane, often slightly umbilicate or centrally depressed, very viscid or glutinous, buff becoming pinkish or vinaceous buff, sometimes tinged with green; lamellae broad, distant, arcuate, decurrent, whitish or sometimes greenish when young; stem slender, sometimes splitting longitudinally, very viscid, colored like the pileus, sometimes greenish at the top; spores elliptic, .00024–.0003 of an inch long, .00016–.0002 broad.

Pileus 5–10 lines broad; stem 1–4 inches long, 1–2 lines thick.

Plants scattered or gregarious, often odorous. Woods and open places. Hamilton, Saratoga and Tompkins counties. July and August.

The green color is due to the gluten and it quickly disappears when the gluten dries. The species is closely related to H. psittacinus Fr. from which it may be separated by the pileus which is neither campanulate nor umbonate and by the lamellae which are paler, less ventricose and more decurrent. The plant is very fragile and must be handled carefully to prevent breaking. In color it resembles H. laetus (Pers.) Fr.

Hygrophorus psittacinus (Schaeff.) Fr.

PARROT HYGROPHORUS

Pileus thin, conic or campanulate becoming nearly plane, somewhat umbonate, striatulate, covered when young with an evanescent greenish gluten, yellowish, reddish or whitish; lamellae thick, subdistant, ventricose, adnate, yellow, more or less tinged with green; stem tough, even, hollow, viscid, green at the top, yellow below; spores .0003 of an inch long, .0002 broad.

Pileus 6–12 lines broad; stem 1–2 inches long, 1–2 lines thick.

Pastures, swamps and clearings, often under brakes, Pteris aquilina L. Lewis county. September to November. Rare

The green color is generally more persistent at the top of the stem than elsewhere, both in this and in the preceding species.

Hygrophorus purus Pk.

PURE HYGROPHORUS

State Mus. Rep't 26. 1874. p. 63.

Pileus thin, fragile, conic becoming expanded and cupulate by the upcurving of the thin margin, very viscid, often irregular, white; lamellae subdistant, broad, ventricose, emarginate with a decurrent tooth, white; stem glabrous, subflexuous, fragile, hollow, very viscid; spores .0003 of an inch long, .0002 broad.

Pileus 1–2 inches broad; stem 3–6 inches long, 2–3 lines thick.

Thin woods. Lewis county. September. Rare. Found but once.

H. calyptraeformis niveus Cke. scarcely differs from this. H. calyptraeformis Berk. differs in its beautiful pink or pinkish rose color.

Hygrophorus luridus B. & C.

LURID HYGROPHORUS

Pileus thin, campanulate or convex becoming nearly plane, umbonate, very viscid, coarsely striate or sulcate striate on the margin, brown or pale brown with a dark center; lamellae thick, distant, ventricose, adnate or slightly decurrent, white; stem slender, hollow, viscid, colored like the pileus; spores .00024-.0003 of an inch long, .0002-.00024 broad.

Pileus 6-12 lines broad; stem 1-2 inches long, 1-1.5 lines thick.

Swamps and damp places. Rensselaer, Saratoga and Hamilton counties. July and August. Not before reported from our State.

The type specimens were collected in North Carolina but our northern plant agrees very well with the description of the species except in having no umbo. No spore characters are given in the original description. The dimensions here given are derived from the spores of the northern plant.

Hygrophorus minutulus Pk.

MINUTE HYGROPHORUS

State Mus. Bul. 2. 1887. p. 9.

Pileus very thin, submembranaceous, convex or expanded, subumbilicate, bright red or orange, viscid, distinctly striatulate when moist, pale red or yellowish when dry; lamellae rather broad, subdistant, sometimes ventricose, adnate or subsinuate and slightly decurrent, whitish tinged with red or yellow; stem short, slender, fragile, solid, viscid when moist, yellowish; spores narrowly elliptic, .0004 of an inch long, .0002 broad, sterigmata .0002-.0003 of an inch long.

Pileus 3-5 lines broad; stem 6-10 lines long, less than .5 of a line thick.

Grassy and mossy places in pastures. Rensselaer county. July. Rare. Found but once.

This is one of our smallest species. Its solid stem does not agree well with the character of the subgenus in which we have placed it, but its bright color indicates its relationship to the species of this subgenus.

Hygrophorus nitidus B. & C.

SHINING HYGROPHORUS

State Mus. Bul. 94. p. 45, pl. 88, fig. 1–7.

Pileus thin, fragile, convex, umbilicate, viscid, pale yellow, shining and striatulate on the margin when moist, whitish when dry; lamellae arcuate, distant, decurrent, pale yellow; stem slender, fragile, viscid, hollow, colored like the pileus; spores .00024–.0003 of an inch long, .0002–.00024 broad.

Pileus 4–12 lines broad; stem 1.5–3 inches long, 1–2 lines thick.

Gregarious or cespitose. Swamps and low damp places. Common. July and August. Edible.

A pretty little mushroom pale yellow throughout, very fragile and very viscid. The yellow color of the lamellae and stem is more persistent than that of the pileus.

Hygrophorus chlorophanus Fr.

SULFURY HYGROPHORUS

State Mus. Mem. 3. p. 147, pl. 51, fig. 13–20.

Pileus thin, fragile, convex becoming nearly plane, often irregular with the margin split or lobed, glabrous, viscid, striate on the margin, pale yellow, sometimes tinged with red in the center; lamellae rather broad, subdistant, thin, ventricose, emarginate, adnexed, pale yellow; stem equal or nearly so, glabrous, viscid when moist, shining when dry, hollow, pale yellow; spores .0003 of an inch long, .0002 broad.

Pileus 8–20 lines broad; stem 1.5–3 inches long, 1–2 lines thick.

Damp or mossy places in woods. Common. July to September. Edible.

Hygrophorus laetus (Pers.) Fr.

PLEASING HYGROPHORUS

Pileus thin, convex, becoming plane, viscid, even or striatulate on the margin, somewhat shining, tawny; lamellae thin, distant, somewhat decurrent, whitish or flesh colored; stem slender, equal, tough, hollow, glabrous, viscid, tawny or pale tawny; spores .00024–.0003 of an inch long, .0002 broad.

Pileus 6–12 lines broad; stem 1–3 inches long, 1–2 lines thick.

Thin woods and pastures. Common. July to September.

When dry the color resembles that of dried specimens of the Peck hygrophorus.

Hygrophorus aurantiacoluteus B. & C., H. cossus (Sow.) Fr. and H. penarius Fr. have been omitted, the specimens formerly referred to these species being doubtful.

NEW YORK SPECIES OF RUSSULA

Russula Pers.

Veil none; hymenophorum descending unchanged into the vesiculose trama; lamellae rigid, fragile, without a milky juice, acute on the edge; spores globose or subglobose, often echinulate or verrucose, white or yellow.

Fleshy putrescent terrestrial fungi.

This genus is closely related to the genus Lactarius, from which it is easily distinguished by the absence of a milky juice. Young plants of some species have the lamellae, when in vigorous growing condition, adorned with small drops of water, but no milky or colored juice issues from wounds as in species of Lactarius. The pileus is destitute of concentric zones, but in the genus Lactarius such markings are frequent. The red colors which are so conspicuous and common in this genus are rarely if ever seen in Lactarius. In the flavor of the flesh there is great similarity. In both genera many species have a mild or an agreeable flavor and many others have an acrid, hot or peppery taste. This disagreeable flavor is generally destroyed in cooking so that nearly all the species that have been tried have been found to be edible.

The genus was divided by Fries into five tribes or subgenera, but these are not sharply limited and are scarcely satisfactory. Nevertheless we have attempted to group our species as nearly as possible in accordance with them. Some species also are so clearly related to each other that they are liable to be confused unless great care and close observation are exercised. It is important to observe the color of the pileus in both young and mature plants, the character of its surface and its margin, the character and color of the lamellae, the taste of the flesh and the color of the spores. Though the species are numerous their general appearance and form are so peculiar and so much alike that it soon becomes easy to recognize the generic character even in an unknown species.

KEY TO THE SUBGENERA

Margin of the mature pileus even 1
Margin of the mature pileus striate 2
1 Lamellae unequal, not often forked .... Compactae

1 Lamellae often forked, narrowed toward each end................Furcatae
1 Lamellae often forked, narrowed toward the stem................Rigidae
2 Lamellae unequal, viscid pellicle adnate................Heterophyllae
2 Lamellae mostly equal, viscid pellicle separable...............Fragiles

Compactae Fr.

Pileus fleshy, compact, firm, without a separable pellicle and without striations on the margin; lamellae unequal; stem firm, solid, rarely cavernous when old.

In all our species the spores are white. In nearly all, wounds of the lamellae or flesh change color. Five of the species are so closely related that in the dried state it is scarcely possible to separate them from each other satisfactorily. Their differential characters are chiefly such as can be ascertained only in the living plant. All are mild or tardily acrid in taste. The compact flesh, even margin of the pileus and unequal lamellae are the prominent characters of this subgenus.

KEY TO THE SPECIES

Pileus changing color with age or in drying........................1
Pileus persistently white or whitish..................................7
1 Pileus becoming smoky brown, grayish brown or blackish..............2
1 Pileus becoming pale tawny or rusty ochraceous......................6
2 Pileus viscid when moist..3
2 Pileus dry...4
3 Lamellae and flesh slowly becoming reddish where wounded.....nigricans
3 Lamellae and flesh not becoming reddish where wounded......subsordida
4 Flesh slowly becoming reddish where wounded............densifolia
4 Flesh not becoming reddish where wounded......................5
5 Flesh becoming black or blackish where wounded................sordida
5 Flesh not changing color where wounded.........................adusta
6 Pileus viscid when moist, odorous......................magnifica
6 Pileus dry, inodorous when fresh........................compacta
7 Lamellae persistently white....................................delica
7 Lamellae becoming subferruginous in drying..................brevipes

Russula nigricans (Bull.) Fr.

BLACKISH RUSSULA

Pileus thick, firm, at first convex and umbilicate with the margin incurved, becoming expanded and centrally depressed, at first white or white clouded with smoky brown, slightly viscid, becoming blackish or blackish brown, flesh white, first slowly changing to a reddish hue when cut or broken then becoming blackish, taste mild; lamellae broad, subdistant, slightly rounded behind, adnexed, white becoming

blackish with age or in drying; stem short, solid, white becoming dingy or smoky brown with age; spores subglobose, .0003–.0004 of an inch long, nearly or quite as broad.

Pileus 3–5 inches broad; stem 1–2.5 inches long, 6–12 lines thick.

Woods and clearings. July and August. Edible.

The dark color of the cooked mushroom gives it an unattractive appearance but its flavor is excellent. This and the following species of which the pileus becomes smoky brown or blackish brown are apt to be infested by the larvae of insects even when quite young. The injury done by them to the flesh causes it to become blackish.

Russula subsordida Pk.

SUBSORDID RUSSULA

State Mus. Bul. 105. p. 40, pl. 99, fig. 1–5.

Pileus firm, convex becoming nearly plane or centrally depressed, glabrous, viscid when young or moist, whitish becoming smoky brown with age, sometimes with an olive-green tint, flesh grayish white, slowly changing to smoky brown when cut or broken, taste mild or slightly and tardily acrid; lamellae thin, close, adnate, whitish becoming black or blackish with age or in drying; stem short, glabrous, solid becoming spongy within and sometimes cavernous, white becoming smoky brown with age or where wounded; spores globose, .0003 of an inch broad.

Pileus 2–5 inches broad; stem 1–1.5 inches long, 6–12 lines thick.

Woods. Warren county. July. Rare. Edible.

Easily distinguished from R. sordida by its viscid pileus. Horicon, Warren co. yet remains the only locality known for this species.

Russula sordida Pk.

SORDID RUSSULA

State Mus. Bul. 105. 1906. p. 39, pl. 98, fig. 1–5.

Pileus convex becoming centrally depressed, dry, glabrous, dingy white becoming smoky brown with age, flesh grayish white, changing to blackish brown or bluish black where cut or broken, taste mild or tardily acrid; lamellae close, unequal, adnate or slightly decurrent, sometimes forked, white changing to black or blackish brown with age or in drying; stem short, firm, equal, solid, colored like the pileus; spores globose, .0003 of an inch broad.

Pileus 3–6 inches broad; stem 1–2 inches long, 6–12 lines thick.

Under hemlock trees. Common in hemlock regions. July. Edible.

From R. subsordida it may be separated by its dry pileus, its more clear white lamellae and by the wounds of the flesh more quickly assuming a blackish color. From R. nigricans and R. densifolia both this and the preceding species may be separated by the absence of reddish hues in the change of color assumed by wounds.

Russula densifolia Secr.

DENSE GILLED RUSSULA

Pileus convex becoming nearly plane or centrally depressed, even, glabrous, whitish becoming gray or sooty brown, sometimes darker in the center, flesh white, slowly changing to reddish and then blackish where wounded, taste mild; lamellae thin, close, adnate or decurrent, white, sometimes tinged with red; stem cylindric, even, solid, slightly pruinose, whitish becoming grayish brown or blackish; spores globose, .0003 of an inch broad.

Pileus 2–4 inches broad; stem 1–2 inches long, 5–9 lines thick.

Woods. Suffolk county and Adirondack mountains. July and August.

Related to R. adusta Fr. from which it is distinguished by wounds of the flesh assuming a reddish color. From R. nigricans Fr. it may be separated by its lamellae being adnate or slightly decurrent and more crowded. Sometimes the lamellae, at their inner extremity, separate from the stem and flesh of the pileus and curve outward and upward. This form appears to be slightly viscid when moist and may prove to be worthy of separation. It is R. densifolia paxilloides Pk. in State Museum bulletin 75, 1904, page 20.

Russula adusta (Pers.) Fr.

SCORCHED RUSSULA

Pileus convex becoming centrally depressed or somewhat infundibuliform, white or whitish becoming brownish or sooty gray, flesh white, not changing color where wounded, taste mild; lamellae thin, narrow, close, adnate or slightly decurrent, sometimes slightly rounded behind, white becoming dingy; stem solid, cylindric, colored like the pileus; spores subglobose, .0003–.0004 of an inch long, .00024–.0003 broad.

Pileus 2–3 inches broad; stem 1–2 inches long, 4–8 lines thick.

Woods. Albany and Warren counties. July to September. Rare.

The notable characters of the species are its thin, close, adnate lamellae changing color but slightly with advancing age, its unchangeable flesh and its mild taste. The plant does not become blackish in drying as do the preceding species but assumes a smoky brown or grayish brown hue. It sometimes grows under pine needles which it pushes up enough to reveal its place of growth.

Russula magnifica Pk.

MAGNIFICENT RUSSULA

State Mus. Bul. 67. 1903. p. 24, pl. N, fig. 1–4.

Pileus convex and umbilicate becoming centrally depressed or infundibuliform, glabrous, viscid when young and moist, even or sometimes slightly rimose squamose in the center, whitish becoming pale rusty ochraceous, flesh white or whitish, odor and taste alkaline, strong and disagreeable; lamellae narrow, close, adnate or slightly decurrent, whitish with a faint pinkish tint, becoming reddish brown where wounded and a dark reddish brown or reddish cinnamon in drying; stem equal or tapering downward, solid becoming spongy or sometimes cavernous within, white or whitish; spores subglobose, even or nearly so, .0003–.0004 of an inch long, .00025–.0003 of an inch broad.

Pileus 4–10 inches broad; stem 2–5 inches long, 8–18 lines thick.

Among fallen leaves in woods. Suffolk county. August. Local.

A limited locality near Port Jefferson is the only station known to me where this species has been found. It is the largest russula known to me and is related to R. compacta Frost and R. brevipes Pk.

Russula compacta Frost

COMPACT RUSSULA

State Mus. Rep't 32. 1879. p.32; State Mus. Bul. 116. pl. 109, fig. 1–4.

Pileus fleshy, compact, broadly convex, sometimes umbilicate becoming centrally depressed or even infundibuliform by the upcurving of the margin, dry or subviscid after heavy rain, unpolished, at first white or whitish, becoming rusty ochraceous, flesh white, taste mild or sometimes slightly and tardily acrid, odor in drying strong and disagreeable; lamellae rather close or subdistant, adnate or slightly rounded behind, unequal, occasionally forked, white, be-

coming reddish brown where wounded and smoky brown in drying; stem short, stout, equal or nearly so, solid, white, but becoming stained with reddish brown in handling or where wounded, and sometimes changing color like the pileus; spores globose or subglobose, .0003–.0004 of an inch long, .0003 broad.

Pileus 3–6 inches broad; stem 1.5–2.5 inches long, 6–12 lines thick.

Ground in woods. Essex, Onondaga, Rensselaer and Suffolk counties. July to September. Edible.

Russula brevipes Pk.

SHORT STEM RUSSULA

State Mus. Rep't 43. 1890. Bot. ed. p. 20, pl. 2, fig. 5–8.

Pileus convex and umbilicate, becoming centrally depressed or infundibuliform, dry, glabrous or nearly so, white or whitish, often with yellowish or rusty yellow stains or patches in the center, flesh whitish, taste mild or slightly and tardily acrid; lamellae thin, close, adnate or decurrent, rarely slightly rounded behind, white becoming tinged with pale cinnamon or ferruginous in age or in drying; stem firm, solid, glabrous, white; spores globose, .0004–.0005 of an inch broad.

Pileus 3–5 inches broad; stem 1–2 inches long, 6–10 lines thick.

Woods and open places. Common. July to October.

This species exhibits less change of color than any of the preceding ones of this subgenus. The lamellae however change with age and in drying and because of this change, their close position, the unpolished and opaque character of the pileus and the slightly acrid taste I have separated it from R. delica, which it closely resembles and to which our plant was formerly referred. It has been referred by Bresadola to R. chloroides (Krombh.) but I have never seen the pileus rimose areolate, nor the lamellae greenish or glaucous as in that species. The lamellae of both this and the following species are sometimes adorned with watery drops in wet weather. In the type form the stem is very short, but when the plant grows among fallen leaves it is longer.

Russula delica Fr.

WEANED RUSSULA

Pileus fleshy, firm, broadly convex and umbilicate, becoming infundibuliform, even, glabrous, shining, white, the margin involute

and without striations; lamellae thin, distant, decurrent, persistently white; stem short, even, glabrous, white; spores subglobose, .0003–.0004 of an inch long, .00024–.0003 broad.

Pileus 2–4 inches broad; stem 1–2 inches long, 4–6 lines thick.

Woods. Saratoga county. Rare.

The specimens referred to this species have the white color of the lamellae more persistent than in any of the preceding species and the lamellae are less crowded than in the short stem russula. Nevertheless they have a pale yellowish hue in the dried state and are scarcely as wide apart as the description of the species would indicate, but the disagreement is so slight that it is not sufficient cause for a separation of our plant.

Furcatae Fr.

Pileus compact, firm, even on the thin margin, the thin pellicle closely adnate; lamellae unequal, some of them forked, commonly narrowed toward each end.

The thin but even margin with acute edge and the forked lamellae are the notable characters of this subgenus. The lamellae do not show decided changes in color with age or in drying, as in most species of the preceding subgenus. In some species the pellicle is separable on the margin.

KEY TO THE SPECIES

Pileus green, olive-green or purple or these intermingled..............1
Pileus whitish tinged with yellow or reddish yellow.........basifurcata
1 Lamellae becoming yellowish with age........................olivascens
1 Lamellae persistently white or whitish..............................2
2 Lamellae subdistant ....furcata
2 Lamellae close, many forked..............................variata

Russula basifurcata Pk

PALE CAP RUSSULA

State Mus. Rep't 38. 1885. p. 90.

Pileus firm, convex, umbilicate, becoming subinfundibuliform, glabrous, slightly viscid when moist, the pellicle separable on the even margin only, dingy white, often tinged with yellow or reddish yellow, flesh white, taste mild, then bitterish; lamellae close, narrowed toward the base, adnate or slightly emarginate, many of them forked at or near the base,, a few short ones intermingled. white becoming yellowish; stem firm, solid, becoming spongy

within, white; spores elliptic, pale yellow, .00035 of an inch long, .00025 of an inch broad.

Pileus 2–3 inches broad; stem 8–12 lines long, 5–6 lines thick.

Dry ground in woods and bushy places. Fulton and Essex counties. July and August.

Closely related to the next following species and like it somewhat related to the subgenus Fragiles in some of its characters.

Russula olivascens Fr.

PALE OLIVACEOUS RUSSULA

Pileus convex or nearly plane, umbilicate, olivaceous or pale green, becoming yellowish in the center, even on the margin, flesh white, taste mild; lamellae narrowed toward the stem, close, slightly adnexed, nearly equal, rarely forked, white becoming yellowish; stem firm becoming spongy within, even, white; spores subglobose, yellowish, .0003–.0004 of an inch long, nearly or quite as broad.

Pileus 2–3 inches broad; stem 1–2 inches long, 4–8 lines thick.

Woods. Suffolk county. August.

This species differs from the preceding in the greenish color of the cap, the gills more equal and rarely forked, the absence of a bitterish flavor and in the more globose yellowish spores.

Russula furcata (Pers.) Fr.

FORKED RUSSULA

Pileus convex becoming nearly plane, centrally depressed or infundibuliform, glabrous, the thin pellicle separable on the thin, even, acute margin, varying from pale yellowish green to dark brownish green, sometimes slightly tinged with purple, flesh white, taste mild; lamellae thickish, subdistant, often forked, unequal, adnate or slightly decurrent, white; stem equal or nearly so, solid or spongy within, white; spores white, subglobose, .0003.–.00035 of an inch long, .00025–.0003 of an inch broad.

Pileus 2–4 inches broad; stem 1.5–3 inches long, 5–8 lines thick.

Woods. Albany county. July.

The European plant is said to have a mild taste becoming bitterish, and no purplish tints are attributed to the pileus. In our plant the bifurcations of the lamellae occur mostly near the inner and outer extremities. It is thus far limited to a single locality near Albany.

Russula variata Banning

VARIABLE RUSSULA

State Mus. Bul. 105. 1906. p. 41, pl. 101, fig. 1–5

Pileus firm, convex becoming centrally depressed or subinfundibuliform, viscid, even, the thin pellicle separable on the thin even margin, reddish purple or brownish purple, often variegated with green or wholly pea-green, flesh white, taste acrid or sometimes slightly and tardily acrid; lamellae thin, narrow, close, often forked, tapering toward each end, adnate or slightly decurrent, white; stem equal or nearly so, solid or sometimes cavernous, white; spores white, subglobose, .0003–.0004 of an inch long, .0003 of an inch broad.

Pileus 2–4 inches broad; stem 1.5–3 inches long, 5–8 lines thick.

Woods. Common and variable. July and August. Edible.

Distinguished from the forked russula by its more forked narrow and closer lamellae and by its acrid flavor. This is destroyed by cooking. The pileus may be dark purple or pinkish purple either wholly or intermingled with pale green or it may be wholly pale green. R. aeruginascens Pk. [State Mus. Rep't 53, p. 843] is a form of this species with yellowish green pileus.

Rigidae Fr.

Pileus compact, firm, commonly dry, without a distinct viscid pellicle, the cuticle often cracking or breaking into adnate scales or furfuraceous granular or mealy particles, the margin typically even, lamellae broader anteriorly causing the margin to appear obtuse.

The most notable character of the group is the dry surface of the pileus becoming squamose, granular, mealy pruinose or unpolished. The margin is commonly even as in the two preceding groups, but there are several exceptions to this. The lamellae are normally forked and unequal, but in a few instances they are nearly equal.

KEY TO THE SPECIES

Pileus green or greenish 1
Pileus some other color 4
1 Pileus even on the margin 2
1 Pileus striate on the margin when mature .... crustosa
2 Taste mild 3
2 Taste acrid .... viridella
3 Surface of the pileus scaly or warty .... virescens
3 Surface of the pileus irregularly rimose on the margin .... cutefracta

3 Surface of the pileus even, not rimose nor squamose............modesta
  4 Stem yellow ....flavida
  4 Stem not yellow 5
5 Pileus pruinose, red or purple...............................mariae
5 Pileus not pruinose...6
  6 Pileus striate on the margin when mature..................crustosa
  6 Pileus even on the margin.......................................7
7 Surface of the pileus polished, taste acrid.......................rubra
7 Surface of the pileus not polished, taste not acrid.................8
  8 Surface of the pileus even, dark red or purplish red..............9
  8 Surface of the pileus often rimose areolate, color variable......lepida
9 Young lamellae white, changing color where wounded............squalida
9 Young lamellae yellow, not changing color where wounded....ochrophylla

Russula viridella Pk.

PALE GREEN RUSSULA

State Mus. Bul. 105. 1906. p. 41, pl. 100, fig. 1–7.

Pileus subglobose, hemispheric or very convex, becoming nearly plane or centrally depressed, even on the margin, dry, soon minutely squamulose or furfuraceous, specially toward the margin, pale grayish green, generally smooth and paler or subochraceous in the center, flesh white, taste acrid; lamellae thin, narrow, close, some of them forked, a few short ones intermingled, white; stem equal or nearly so, even, solid or spongy within, white; spores white tinged with yellow, globose or subglobose, .00024–.0003 of an inch long, nearly as broad, cystidia subfusiform, .0025–.003 of an inch long, .0006 broad.

Pileus 2–4 inches broad; stem 2–3 inches long, 5–8 lines thick.

Under hemlock trees. Horicon, Warren co. July. Edible.

It has yet been found in no other locality so far as we know. The acridity is destroyed by cooking.

Russula virescens (Schaeff.) Fr.

GREENISH RUSSULA

State Mus. Rep't 48. Bot. ed. p. 189, pl. 31, fig. 1–8.

Pileus fleshy, at first nearly globose, soon convex or nearly plane often becoming centrally depressed, dry, adorned with small flocculent patches or warts, the margin even, green or grayish green, flesh white, taste mild; lamellae moderately close, narrowed toward the stem, free or nearly so, a few of them forked and a few shorter ones sometimes intermingled, white; stem short, firm, white; spores subglobose, white, .00024–.0003 of an inch long.

Pileus 2–4 inches broad; stem 1–2 inches long, 6–10 lines thick.

Thin woods and in grassy open places. Not rare. July and August. Edible.

The margin of the pileus is usually even but occasionally in old specimens it may be partly striate.

Russula cutefracta Cke.

BROKEN SKIN RUSSULA

Pileus convex becoming centrally depressed, dry, even on the margin, the cuticle cracking somewhat radiately but irregularly on the margin, color variable, green, red or purple, flesh white, purplish under the cuticle, taste mild; lamellae narrowed toward the base, somewhat close, some forked, adnexed or nearly free, white; stem solid, firm, nearly equal, whitish or tinged with purple; spores globose, .0004 of an inch broad.

Pileus 3–4 inches broad; stem 2–3 inches long, 6–10 lines thick.

Woods and their borders. Albany county. October.

I have admitted this species on the strength of a single specimen which agrees very closely with Cooke's figure 1040, illustrating the form with green pileus. Still it differs in having the flesh white instead of pinkish under the cuticle. It must be an extremely rare species with us.

Russula crustosa Pk.

CRUSTOSE RUSSULA

State Mus. Bul. 67. 1903. p. 45, pl. 84, fig. 1–7.

Pileus convex becoming nearly plane or centrally depressed, marked with small appressed areolate scales except on the smooth mostly depressed and sometimes subviscid disk, striate on the margin when mature, color variable, stramineous, pale ochraceous, brownish ochraceous, greenish or greenish yellow, rarely brownish purple, the center sometimes paler, sometimes darker than the margin, flesh white, taste mild or slightly and tardily acrid; lamellae moderately close, narrowed toward the stem, some of them forked, some short, white; stem short, stout, equal, stuffed or hollow, white; spores subglobose, white, .0003–.0004 of an inch long, .00025–.0003 of an inch broad.

Pileus 3–5 inches broad; stem 1–2.5 inches long, 6–12 lines thick.

Woods and open places. Common. July and August. Edible.

The striate margin separates this species from all the others in this subgenus. In this it is nearly always present in the mature

plants, in some of the other species it may sometimes appear but it is exceptional. This character militates against the character of the subgenus and connects with the next following one. Sometimes the cuticle cracks on the margin very much as in R. cutefracta but the paler and different colors of the pileus, the white flesh beneath the cuticle and the striate margin easily prevent any confusion of these species. The scales of the pileus often appear as if formed from the breaking up of a crustose cuticle. This sometimes has a grayish appearance.

Russula modesta n. sp.

MODEST RUSSULA

Pileus firm but thin and flexible, broadly convex, becoming nearly plane or centrally depressed, dry, pruinose, even or obscurely striate on the margin, greenish gray, paler on the margin, flesh white, taste mild; lamellae thin, close, many forked at the base, a few short ones, narrowed toward each end, adnate or slightly decurrent, white becoming yellowish, the interspaces venose; stem short, cylindric, solid, glabrous, white; spores subglobose, pale yellowish, .00025–.0003 of an inch long, nearly as broad.

Pileus 1–2.5 inches broad; stem 1–1.5 inches long, 3–5 lines thick.

Woods. Albany county. July.

This species differs from its allies in the pruinose appearance of the surface of the pileus. Under a lens, this is seen to be due to a minute whitish tomentose pubescence. A form of this species with the pileus more distinctly green has been received from Miss T. L. Smith who collected it under oak trees and reports it to be edible.

Russula flavida Frost

YELLOWISH RUSSULA

State Mus. Bul. 105. 1906. p. 38, pl. 97, fig. 1–6.

Pileus firm, convex becoming nearly plane or centrally depressed, dry, frequently sprinkled with minute mealy yellowish particles, specially on the margin, pale yellow, sometimes brighter yellow or orange in the center, flesh white, taste mild; lamellae rather thick, moderately close, entire or nearly so, adnate, white; stem equal or slightly tapering upward, solid, sometimes becoming spongy within, occasionally cavernous, colored like the pileus or a little paler, sometimes brighter at the base; spores yellowish, subglobose, .0003 of an inch long, nearly as broad.

Pileus 2–3 inches broad; stem 1.5–3 inches long, 4–8 lines thick.

Woods and bushy places. Rensselaer, Suffolk and Warren counties. July and August. Edible.

The margin of the pileus in old plants sometimes becomes striate and occasionally fades to white. The species is easily recognized by having both stem and pileus yellow and the intervening lamellae white.

Russula lepida Fr.

SCALY RUSSULA

Pileus firm, compact, convex becoming nearly plane, dry, unpolished, often rimose areolate in part, even on the margin, variable in color, red, bright red, red in the center with yellowish margin or wholly yellow, flesh white, taste mild becoming somewhat acrid or disagreeable; lamellae close, narrowed toward the stem, rounded behind or slightly decurrent, some forked at the base, a few short ones intermingled, white becoming yellowish; stem equal or nearly so, solid, white or whitish, sometimes reddish; spores globose, yellowish, .0003–.0004 of an inch in diameter.

Pileus 2–4 inches broad; stem 1–2.5 inches long, 6–10 lines thick.

Woods. Albany and Suffolk counties. July and August. Not common.

The description here given applies to the American plant, which differs slightly in color from the European. The disk in that species is said in *Sylloge* to always become whitish, a character not yet observed in our plant. In this the disk sometimes is red while the margin is yellow. The lamellae also, in drying, usually assume a subochraceous or pale cinnamon hue, which character is not attributed to the European plant. The edge of the lamellae is sometimes red near the margin of the pileus. The European plant is said to have the stem almost always stained or spotted with red. In ours it is more often white.

Russula rubra Fr.

RED RUSSULA

Pileus fleshy, hard, rigid, convex becoming nearly plane or centrally depressed, dry, polished, even on the obtuse sometimes wavy margin, very red, almost shining, often darker in the center, flesh white, reddish under the cuticle, taste acrid; lamellae rather close, adnate, broad, unequal, some of them forked, white becoming yellowish with age; stem hard, solid, white or red; spores white, globose or subglobose, .0003–.0004 of an inch long.

Pileus 2–4 inches broad; stem 2–3 inches long, 6–10 lines thick.

Woods. Albany, Madison, Rensselaer and Suffolk counties. July and August.

Distinguished from other members of this subgenus by its smooth polished pileus and its very acrid taste. Var. sapida Cke. (R. atropurpurea Krombh.) is said to be mild in flavor, but otherwise like the species. I have not seen it.

Russula squalida nom. nov.

SQUALID RUSSULA

Russula atropurpurea Pk. State Mus. Rep't 41. 1888. p. 75.

Pileus convex becoming centrally depressed, glabrous, dark purple, often blackish in the center, even or slightly striate on the margin when old, flesh white, grayish or grayish purple under the cuticle, taste mild, odor in drying fetid; lamellae subdistant, a few forked at the base, occasionally a short one intervening, white becoming yellowish, brownish where wounded; stem equal, glabrous, solid or spongy within, white, brownish where bruised; spores pale ochraceous with a salmon tint, subglobose, .0003–.0004 of an inch long, nearly as broad.

Pileus 3–4 inches broad; stem 2–3 inches long, 5–8 lines thick.

Margin of woods. Saratoga county. July.

In the dried state this russula has a peculiar dingy and unattractive appearance. It is very distinct in the unusual color of the spores and the brownish hue assumed where wounded. Agaricus atropurpurea Krombh. being a species of Russula, it becomes necessary to give a new name to the plant to which this specific name was formerly applied by me.

Russula ochrophylla Pk.

OCHERY GILLED RUSSULA

State Mus. Rep't 50. 1897. p. 100; State Mus. Mem. 3. 1900. p. 150, pl. 54, fig. 8–14.

Pileus firm, convex becoming nearly plane and umbilicate or centrally depressed, dry, unpolished, even on the margin, dark red or purplish red, often a little darker in the center, flesh white, red under the adnate cuticle, taste mild; lamellae subdistant, adnate, nearly entire, a few forked at the base, yellowish becoming bright ochraceous buff, dusted by the spores, the interspaces somewhat venose; stem equal or nearly so, solid or spongy within, reddish

but paler than the pileus; spores bright ochraceous buff, globose, .0004 of an inch broad.

Pileus 2–4 inches broad; stem 1.5–2.5 inches long, 6–10 lines thick.

Ground under oak trees. Albany county. July. Rare. Edible.

There is a var. albipes Pk. in which the pileus is deeper red and the stem white. If this mushroom is stewed in milk or cream without peeling, it imparts a pinkish purple hue to the liquid.

Russula mariae Pk.

MARY RUSSULA

State Mus. Rep't 24. 1872. p. 74; State Mus. Bul. 75. 1904. p. 29, pl. 85, fig. 1–8.

Pileus nearly hemispheric becoming broadly convex, plane or centrally depressed, dry, pruinose or minutely pulverulent, dark crimson or purplish, sometimes darker in the center than on the margin, rarely striate on the margin when old, flesh white, pinkish under the cuticle, taste mild or slightly and tardily acrid; lamellae rather close, adnate, white becoming yellowish with age; stem equal, solid or slightly spongy within, colored like or a little paler than the pileus, usually white at each end, rarely entirely white; spores pale yellow, globose, .0003 of an inch broad.

Pileus 1–3 inches broad; stem 1–2 inches long, 3–5 lines thick.

In woods and in open places. Common. July and August. Edible.

This species is easily distinguished by its pruinose or minutely granular cap. When moistened and rubbed on white paper it communicates reddish stains to it. A few of the lamellae are forked at the base. The pileus sometimes fades with age, specially in purplish specimens, and on the margin. Such specimens resemble Russula depallens (Pers.) Fr. as shown in Cooke's figure 1021.

Russula lactea (Pers.) Fr. is omitted; the specimens referred to it belong to Russula albella Pk.

Heterophyllae Fr.

Pileus fleshy, firm, with a thin viscid adnate pellicle and a thin, usually striate margin; lamellae unequal, some of them forked; stem stout, solid, spongy within.

The viscid pileus and striate margin separate this tribe from the preceding one; the firm pileus, adnate pellicle and unequal lamellae

separate it from the following one. Fries included in it a few species with the margin of the pileus even or obscurely striate.

KEY TO THE SPECIES

Pileus even or but slightly striate on the margin.................... 1
Pileus distinctly striate on the margin................................ 4
1 Taste mild.. 2
1 Taste acrid.. consobrina
2 Lamellae distant.. earlei
2 Lamellae close... 3
3 Lamellae broad, rounded behind, white.......................... cyanoxantha
3 Lamellae rather narrow, whitish................................ vesca
4 Pileus brown or brownish...................................... sororia
4 Pileus yellowish, reddish yellow or subochraceous................. 5
5 Pileus roughened with granules................................ granulata
5 Pileus smooth.. 6
6 Pileus stramineous or subochraceous........................... foetens
6 Pileus reddish yellow.. foetentula

Russula vesca Fr.

EDIBLE RUSSULA

Pileus fleshy, rather firm, nearly plane or centrally depressed, viscid, venosely rugulose or radiately wrinkled with a spreading, even margin, reddish or flesh color, darker in the center, flesh white, taste mild; lamellae thin, close, adnate, unequal, whitish; stem solid, compact, rigid, white; spores globose, white, .0003–.0004 of an inch broad.

Pileus 2–4 inches broad; stem 1–2 inches long, 4–8 lines thick.

Woods. Warren county. August. Rare.

The species may easily be recognized by the minutely radiately wrinkled or rugulose character of the upper surface of the pileus. The wrinkles or veins commonly radiate toward the margin but they often anastomose in a reticulate manner. In the typical form the pileus is pinkish or red flesh color. In our specimens it is mostly greenish, but darker or blackish green in the center where it is also in some specimens varied with reddish or brownish red hues. The European plant is edible as indicated by the name. I have not tested our plant.

Russula cyanoxantha (Schaeff.) Fr.

YELLOWISH BLUE RUSSULA

Pileus compact, convex becoming centrally depressed or subinfundibuliform, viscose, variable in color, even on the margin or

sometimes becoming slightly striate, purplish, lilac or olive-green, commonly becoming paler or yellowish in the center, flesh white, taste mild; lamellae broad, moderately close, rounded behind, pure white; stem spongy within, even, glabrous, white; spores subglobose, .0003–.0004 of an inch long, .00024–.0003 broad.

Pileus 2–4 inches broad; stem 2–3 inches long, 5–8 lines thick.

Woods. Albany and Washington counties. July. Not common.

The pileus is sometimes bluish on the margin and yellowish in the center, a character suggestive of the specific name, but not represented in any of our specimens. The flesh is sometimes reddish under the cuticle. The stem may become hollow in old specimens.

Russula earlei Pk.

EARLE RUSSULA

State Mus. Bul. 67. 1903. p. 24, pl. N, fig. 5–10.

Pileus fleshy, firm, hemispheric becoming broadly convex or nearly plane, sometimes centrally depressed, glabrous, very viscid, the margin even, stramineous becoming paler with age, flesh whitish or yellowish, taste mild; lamellae thick, distant, adnate, a few short, whitish becoming yellowish; stem short, firm, equal or nearly so, solid, becoming spongy within, white; spores white, subglobose, .0002–.00024 of an inch long.

Pileus 1.5–2.5 inches broad; stem 1–1.5 inches long, 3–5 lines thick.

Among fallen leaves in woods. Suffolk county. August.

This species is well marked by its pale and glutinous pileus, its distant lamellae and its small spores.

Russula consobrina Fr.

COUSIN RUSSULA

Pileus fleshy, convex or subhemispheric becoming centrally depressed, viscid, even on the membranaceous margin, gray, olive-brown or umber, flesh white, ashy gray under the pellicle, taste acrid; lamellae close, adnate, many forked and many short, white; stem firm, equal, spongy within, white becoming dingy or cinereous with age; spores white, subglobose, .0003–.0004 of an inch long, nearly as broad.

Pileus 2–4 inches broad; stem 1–3 inches long, 4–10 lines thick.

In woods. Otsego county. July. Rare.

Some of our specimens differ from the description in having a yellowish brown pileus.

Russula sororia Fr.

SISTER RUSSULA

Pileus convex becoming nearly plane, viscid when moist, striate on the thin margin, gray, grayish brown, olive-brown or yellowish brown, often darker in the center, flesh whitish, taste acrid; lamellae narrow, subdistant, adnate, many of them short, rarely forked, whitish or pallid, the interspaces venose; stem equal or slightly tapering upward, white; spores globose, white, .0003 of an inch broad.

Pileus 1–2.5 inches broad; stem 1–2 inches long, 4–8 lines thick.

Woods and groves. Albany and Suffolk counties. July to September.

Similar in color and character to R. consobrina Fr. of which it is thought by some to be a variety, but it is easily distinguished by its distinctly striate margin. R. pectinatoides Pk. resembles this in color but it may be distinguished from it by its mild or tardily and slightly acrid taste and its nearly equal lamellae.

A form with the pileus darker brown, flesh cinereous under the cuticle and stem becoming cinereous was found under chestnut trees near Gansevoort, Saratoga co. It is referable to R. consobrina intermedia Cke.

Russula granulata Pk.

GRANULATED RUSSULA

State Mus. Rep't 53. 1900. p. 843.

Pileus convex becoming nearly plane or centrally depressed, viscid when moist, rough with minute granules or squamules, tuberculate striate on the margin, dingy ochraceous or dingy yellow, tinged with red or brown, flesh white or whitish, taste acrid; lamellae thin, close, adnate, many forked at the base; stem equal or abruptly contracted at the top, glabrous, spongy within, whitish; spores white, subglobose, .0003 of an inch broad.

Pileus 2–3 inches broad; stem 1–1.5 inches long, 6–8 lines thick.

Woods. Ulster and Hamilton counties. August.

In State Museum Report 39, page 57 this was regarded as a variety of R. foetens Fr. from which it differs in its granular pileus, its closer and more narrow lamellae and in the absence of

odor. From R. granulosa Cke. it may be separated by its glabrous stem, smaller spores and adnate lamellae. R. granulata lepiotoides Atk. is a variety having the surface of the pileus rimose squamose.

Russula foetens (Pers.) Fr.

FETID RUSSULA

Pileus fleshy, fragile, subglobose or convex becoming plane or centrally depressed, viscid when moist, widely tuberculose sulcate or striate on the very thin margin, yellowish or dingy ochraceous, flesh pallid, taste acrid, odor strong, amygdaline; lamellae rather close, adnexed, unequal, some of them forked, whitish and often studded with drops of moisture when young, becoming yellowish with age, dingy where bruised, interspaces venose; stem short, stout, stuffed becoming irregularly hollow, white or whitish; spores white, subglobose, .0003–.0004 of an inch long, nearly or quite as broad.

Pileus 3–5 inches broad; stem 1.5–2.5 inches long, 6–12 lines thick.

Woods and bushy places. Common. July to September.

Readily recognized by its peculiar odor, acrid taste and widely striate margin. Gregarious in habit and somewhat variable in color.

Russula foetentula n. sp.

SLIGHTLY FETID RUSSULA

Pileus thin, nearly plane, viscid, glabrous, striate on the margin, reddish yellow, flesh white, taste tardily acrid, odor like that of almonds; lamellae thin, narrow, close, adnexed or nearly free, whitish, the interspaces venose; stem equal, firm, cavernous, white or yellowish white, usually spotted or stained with reddish brown at the base; spores very pale yellow, globose, .0003–.00035 of an inch broad.

Pileus 1.5–3 inches broad; stem 1–1.5 inches long, 3–5 lines thick.

Among fallen leaves in woods. Suffolk county. August.

This species is related to R. foetens Fr., to which it is similar in odor but from which it differs in its closer lamellae and reddish brown or burnt sienna color at the base of the stem.

The specimens reported in State Museum Report 35, page 135 under the name Russula heterophylla Fr. are doubtful and the species is therefore omitted.

Fragiles Fr.

Pileus fragile, covered with a thin separable or subseparable pellicle, viscid when moist, thin on the margin which is commonly striate or tuberculose striate in the mature plant; lamellae equal or nearly so, broader anteriorly; stem soft, spongy or hollow.

The fragile character of the pileus, the viscid separable pellicle, the thin and ultimately striate or tuberculose striate margin and the usually equal simple lamellae are the prominent distinguishing features of this subgenus. Its species outnumber those of any other subgenus of Russula. They may be divided into three groups depending on the color of the spores, which color is frequently indicated by the color of the mature lamellae. There are some exceptional or anomalous cases in which all the characters attributed to this tribe are not shown by species included in it. In some species the pileus is not viscid or the margin is not striate or the pellicle may be separable on the margin but not on the disk. The tuberculose character of the marginal striations is apparently due to the venose interspaces.

KEY TO THE SPECIES

Spores white or whitish..1
Spores pale yellow or citrine..................................10
Spores ochraceous..20
1 Pileus red or reddish...2
1 Pileus ochraceous or yellowish brown..........................7
1 Pileus white or whitish.......................................8
2 Taste acrid...3
2 Taste mild..6
3 Pileus even...4
3 Pileus rugulose...rugulosa
4 Pileus darker colored in the center...........................fallax
4 Pileus typically uniformly colored............................5
5 Lamellae rounded behind, subfree, subdistant..................emetica
5 Lamellae adnexed, close.......................................fragilis
6 Stem white or reddish...uncialis
6 Stem red or deep red..purpurina
7 Stem white..pectinatoides
7 Stem pale ochraceous..simillima
8 Taste acrid...anomala
8 Taste mild..9
9 Pileus dry..albella
9 Pileus viscid...albida
10 Pileus red or some shade of red..............................11
10 Pileus some other color......................................17
11 Taste acrid..veternosa
11 Taste mild or slightly and tardily acrid.....................12

12 Lamellae distant..integra
12 Lamellae close..13
13 Pileus more than 1 inch broad...............................14
13 Pileus less than 1 inch broad...........................pusilla
14 Stem and flesh becoming cinereous...........................15
14 Stem and flesh not becoming cinereous.......................16
15 Pileus red or orange.................................decolorans
15 Pileus violaceous, purple or dark red...................obscura
16 Stem white, often with reddish stains.................palustris
16 Stem white with yellowish stains......................puellaris
17 Lamellae distant..integra
17 Lamellae close..18
18 Pileus yellow, even on the margin.........................lutea
18 Pileus yellow, striate on the margin........................19
19 Stem white becoming cinereous..........................constans
19 Stem persistently white...............................flaviceps
20 Stem tinged with red by minute red granules............roseipes
20 Stem not adorned with red granules..........................21
21 Pileus distinctly striate on the margin.....................22
21 Pileus slightly striate when old............................23
22 Lamellae pale yellow when mature.......................abietina
22 Lamellae ochraceous when mature..........................turci
23 Plant small, lamellae very close...................chamaeleontina
23 Plant large, lamellae subdistant.......................alutacea

Russula emetica Fr.

EMETIC RUSSULA

Pileus fleshy, firm becoming fragile, convex becoming plane or centrally depressed, glabrous, viscid when moist, striate sulcate on the margin, rosy or blood-red, sometimes white or fading to white, flesh white, reddish under the separable pellicle, taste very acrid; lamellae equal, broad, subdistant, rounded behind and free or nearly so, white; stem solid or spongy within, elastic when young, becoming fragile, even, white or tinged with red; spores white, globose, .0003–.0004 of an inch broad.

Pileus 2–4 inches broad; stem 1.5–3 inches long, 3–6 lines thick.

Woods and swamps. Common. July to September.

This russula has a very acrid or peppery taste and is generally considered poisonous by European mycologists, but deemed edible and harmless by some American mycophagists. Thorough cooking probably destroys its harmful properties. I have not tried it.

Russula rugulosa Pk.

RUGULOSE RUSSULA

State Mus. Rep't 54. 1901. p. 179, pl. 72, fig. 12–18.

Pileus rather thin, fragile, convex becoming nearly plane or centrally depressed, viscid when moist, uneven with small tubercles and wrinkles, even on the margin when young, becoming tuberculose striate with age, the viscid pellicle separable on the margin, flesh white, reddish under the pellicle, taste acrid or tardily acrid; lamellae moderately close, adnate or slightly rounded behind, white; stem nearly equal, spongy within, white; spores white, subglobose, .0003–.0004 of an inch long, nearly or quite as broad.

Pileus 2–4 inches broad; stem 2–3 inches long, 4–8 lines thick.

Woods among mosses and fallen leaves. Franklin county. August and September. Edible.

Most closely allied to R. emetica Fr. from which it is distinguished by its rugulose pileus and less acrid or tardily acrid taste. The slight acridity is dispelled in cooking and it affords a harmless, tender and agreeable food. From R. vesca Fr. it may be distinguished by its tardily acrid taste and its striate margin.

Russula fallax (Schaeff.) Sacc.

FALLACIOUS RUSSULA

Pileus thin, fragile, convex or nearly or quite plane, viscid when moist, reddish with a darker center, flesh white, taste acrid; lamellae thin, adnexed, distant, whitish or pallid; stem slender, subequal, white; spores white, subglobose, .0003 of an inch long.

Pileus 1–2 inches broad; stem 1–2 inches long, 3–5 lines thick.

Moist places. Not rare. August.

This is R. emetica var. fallax Cke. and R. fragilis var. fallax Massee. We have followed Saccardo in recognizing its specific validity. In our specimens the lamellae appear to be less distant than in the typical form, but in other respects the agreement is good.

Russula fragilis (Pers.) Fr.

FRAGILE RUSSULA

Pileus very thin and fragile, convex becoming plane or slightly depressed in the center, with a thin pellicle somewhat viscid when moist, sometimes umbonate, tuberculose striate on the margin, polished, variable in color, typically pale red, sometimes fading to white,

flesh thin, white, not red under the separable pellicle, taste acrid; lamellae thin, close, adnexed, ventricose, sometimes slightly uneven or eroded on the edge, white; stem slender, spongy within or hollow, white; spores white, subglobose, .0003–.0004 of an inch long.

Pileus 1–2 inches broad; stem 1–1.5 inches long, 3–5 lines thick.

Woods and swamps. Not rare in hilly and mountainous wooded districts. July and August.

Var. nivea (Pers.) Cke. Whole plant white from the first. Rainbow, Franklin co. August.

The species is closely allied to R. emetica Fr. from which it may be separated by its smaller size, paler color, thinner flesh, white under the pellicle, and closer lamellae.

Russula uncialis Pk.

INCH WIDE RUSSULA

State Mus. Bul. 2. 1887. p. 10; State Mus. Bul. 116. pl. 107, fig. 7–12.

Pileus thin, convex becoming plane or centrally depressed, viscid when moist, glabrous or very minutely granulose, red or pinkish red, obscurely tuberculose striate on the margin, flesh white, taste mild; lamellae moderately close, narrowed toward the stem near which a few of them are forked, adnate or slightly emarginate, white becoming pallid, the interspaces venose; stem equal, glabrous, stuffed or spongy within, white or reddish; spores white globose, .0003–.00035 of an inch broad.

Pileus 1–1.5 inches broad; stem 1–1.5 inches long, 2–4 lines thick.

Woods. Rensselaer county. June and July. Rare.

It is unusual to find a red capped, white spored species of this subgenus with a mild taste. This and the next following species are our only examples of this kind.

Russula purpurina Q. & S.

PURPURINE RUSSULA

Pileus fleshy, fragile, subglobose becoming plane or slightly depressed in the center, sometimes cup-shaped by the upcurving of the margin, with a separable pellicle, acute and even or nearly so on the margin, deep red, flesh white, reddish under the pellicle, taste mild; lamellae moderately close, subequal, a little narrowed behind, white becoming yellowish with age or in drying; stem rather long, cylindric or sometimes slightly tapering above or below, stuffed or

spongy within, colored like the pileus or a little paler, sometimes whitish at the base; spores white, globose or subglobose, .0003–.0004 of an inch long, nearly or quite as broad.

Pileus 1.5–3 inches broad; stem 2–3 inches long, 4–6 lines thick.

Woods. Adirondack region. August and September.

The brilliant red color of the pileus and stem make this one of our most beautiful and attractive species of russula. The lamellae have a few short ones intermingled and the edge often appears floccose under a lens and red near the margin of the pileus. Pointed cystidia are numerous.

Russula pectinatoides Pk.

PECTENLIKE RUSSULA

PLATE 105, FIG. 6–10

Pileus thin, broadly convex becoming nearly plane or centrally depressed, viscid when moist, widely tuberculose striate on the margin, dingy straw color, brownish, yellowish brown or cinereous brown, sometimes darker in the center, flesh white, grayish white under the separable pellicle, taste mild or slightly and tardily acrid; lamellae thin, equal or with an occasional short one, some forked at the base, adnate, white becoming pallid; stem equal or nearly so, even, glabrous, spongy within, white; spores whitish, subglobose, .00025–.0003 of an inch long, nearly or quite as broad.

Pileus 1–3 inches broad; stem 1–2 inches long, 3–4 lines thick.

Grassy ground in groves and woods. Albany and Suffolk counties. July and August.

Specimens of this species were formerly reported as R. pectinata Fr. from which it seems best to separate them as they differ in their milder taste, the grayish color of the flesh under the cuticle, the adnate lamellae and the even stem. From R. sororia Fr. the species differs in its milder taste. In the character of the lamellae it is related to that species and might with almost equal propriety be placed in the same subgenus with it. It is edible.

Russula simillima Pk.

VERY SIMILAR RUSSULA

State Mus. Rep't 24. 1872. p. 75.

Pileus hemispheric or convex becoming plane or slightly depressed in the center, viscid when young or moist, striate on the

margin when mature, pale ochraceous, sometimes more highly colored in the center, flesh white, taste acrid; lamellae nearly equal, some forked near the stem, broader anteriorly, yellowish; stem equal or slightly tapering upward, spongy within, rarely hollow, colored like the pileus or a little paler; spores white, globose or nearly so, .0003 of an inch broad.

Pileus 1–3 inches broad; stem 2–3 inches long, 4–9 lines thick.

Woods. Adirondack region. August and September.

Related to R. ochroleuca (Pers.) Fr. and R. claroflava Grove but differing from both in having the stem pale ochraceous. It may be separated from R. ochracea (A. & S.) Fr. by its acrid taste and white flesh and spores. From R. fellea Fr. which it most closely resembles, the similarity justifying the specific name, it scarcely differs except in having the lamellae and stem pale ochraceous from the first, and the flesh white.

Russula anomala Pk.

ANOMALUS RUSSULA

State Mus. Rep't 50. 1897. p. 99.

Pileus thin, fragile, nearly plane or slightly depressed in the center, dry, striate on the margin, white, sometimes tinged with yellow, flesh white, taste acrid; lamellae thin, moderately close, adnate, equal or with an occasional short one, white, dusted with the white spores when dry; stem equal, solid or spongy within, white; spores subglobose, .0003–.00035 of an inch long, nearly or quite as broad.

Pileus 1–1.5 inches broad; stem 1–1.5 inches long, 3–4 lines thick.

Damp ground under trees. Suffolk county. July. Rare.

The anomalous character of this species is found in the pileus which is destitute of the viscid separable pellicle characteristic of this subgenus. Notwithstanding the absence of this character, the fragile pileus with its thin striate margin and the nearly equal lamellae point to this as its proper place in the genus. From R. fragilis nivea (Pers.) Cke. which it closely resembles it may be distinguished by its dry pileus, adnate lamellae and solid stem. Found but once.

Russula albida Pk.

WHITISH RUSSULA

State Mus. Bul. 2. 1887. p. 10; State Mus. Bul. 105. 1906. p. 38, pl. 96, fig. 1-7.

Pileus thin, fragile, hemispheric or very convex becoming nearly plane or slightly depressed in the center, slightly viscid when moist, white, often tinged with yellow in the center, even or slightly striate on the margin, flesh white, taste mild or slightly and tardily bitterish and unpleasant; lamellae thin, moderately close, entire, occasionally forked at the base, adnate or subdecurrent, white or whitish, the interspaces often venose; stem equal or slightly tapering upward, glabrous, stuffed or hollow, white; spores white or with a faint yellowish tinge, subglobose, .0003-.00035 of an inch long, nearly or quite as broad.

Pileus 1-2 inches broad; stem 1-3 inches long, 3-5 lines thick.

Among fallen leaves in woods. Rensselaer and Suffolk counties. July and August. Edible.

The slowly developed unpleasant taste of the fresh plant is lost in cooking. The thin margin of the cap is sometimes curved upward in old plants. Distinguished from R. lactea Fr., which it resembles in color, by its separable, slightly viscid pellicle, its adnate or subdecurrent closer lamellae and its stuffed or hollow stem. By the adnate lamellae and mild taste it may be distinguished from whitened forms of R. emetica Fr.

Russula albella Pk.

SLIGHTLY WHITE RUSSULA

State Mus. Rep't 50. p. 101.

Pileus thin, fragile, dry, plane or slightly depressed in the center, even or obscurely striate on the margin, white or whitish, sometimes tinged with pink or rose-red, specially on the margin, flesh white, taste mild; lamellae thin, close, equal, white; stem equal, solid or spongy within, white; spores white globose, .0003 of an inch broad.

Pileus 2-3 inches broad; stem 1-2 inches long, 3-4 lines thick.

Dry soil in woods. Suffolk county. July. Rare.

This species, like R. anomala Pk. departs from the usual character of the species of this subgenus in having a dry pileus. The fragile pileus and equal lamellae, however, indicate its close

relationship to this subgenus. From R. lactea Fr. it differs in its fragile texture, equal lamellae and the surface of the pileus not cracking and forming areolae.

Russula veternosa Fr.

LANGUISHING RUSSULA

Pileus convex becoming plane or centrally depressed, covered with a slightly viscid adnate pellicle, even on the margin, red or flesh-colored, typically becoming whitish or yellowish in the center, flesh white, taste acrid; lamellae narrow, broader in front, close, adnate, a few shorter ones intermingled, white becoming yellowish; stem equal, even, fragile, soft, spongy within becoming hollow, white; spores pale yellow, subglobose, .0003–.00035 of an inch long, nearly as broad.

Pileus 2–3 inches broad; stem 2–3 inches long, 5–8 lines thick.

Thin woods. Saratoga county. August. Rare.

In our specimens the pileus is in some cases a little paler in the center than on the margin, but none of them is centrally whitish or yellowish as in the typical form. The red pileus with even margin, the acrid taste and pale yellow spores are distinguishing characters in this species.

Russula integra (L.) Fr.

ENTIRE RUSSULA

Pileus firm, becoming fragile, convex becoming plane or centrally depressed, covered with a viscid separable pellicle, thin on the margin which is at length coarsely tuberculose striate, variable in color, flesh white, taste mild; lamellae broad, nearly free, equal, distant, white becoming pale yellow, dusted by the spores; stem at first short, conic, becoming clavate, even, ventricose, sometimes cylindric, spongy within, white; spores pale yellow, subglobose, .0003–.0004 of an inch long, nearly or quite as broad.

Pileus 3–5 inches broad; stem 1.5–2.5 inches long, 6–12 lines thick.

Woods. Adirondack region. July and August. Rare.

The specimens which we have referred to this species are dark red and do not always have the margin distinctly tuberculose striate. The stem is cylindric or sometimes thickened toward the base.

Var. rubrotincta Pk. Stem tinged with red. Otherwise as in the typical form.

Russula palustris Pk.

SWAMP RUSSULA

State Mus. Rep't 53. 1900. p. 842.

Pileus thin, fragile, subglobose or hemispheric becoming convex or nearly plane, viscid when moist and covered with a separable pellicle, obscurely tuberculose striate on the margin, reddish buff to purplish red, flesh white, tinged with reddish buff under the pellicle, taste tardily acrid; lamellae entire, moderately close, whitish becoming yellowish, interspaces venose; stem equal, glabrous, spongy within or hollow, fragile, white or tinged with red; spores pale yellow, subglobose, .0003–.0004 of an inch long, uninucleate.

Pileus 2–3 inches broad; stem 1.5–3 inches long, 4–6 lines thick.

Swamps, under alders. St Lawrence county. August. Rare.

Related to R. decolorans Fr. but smaller, thinner, more fragile, tardily acrid and not discoloring or assuming cinereous hues with age.

Russula decolorans Fr.

DISCOLORED RUSSULA

Pileus fleshy, firm, globose becoming plane or centrally depressed, slightly viscid when moist, polished, even on the margin, becoming striate with age, orange-red becoming paler with age, flesh white, becoming cinereous and variegated with black spots when broken, taste mild; lamellae thin, close, adnexed, fragile, sometimes forked at the base, white becoming yellowish; stem long, cylindric, solid or spongy within, white becoming cinereous, specially within; spores subglobose, yellowish, .0003–.0004 of an inch long, nearly as broad.

Pileus 2–4 inches broad; stem 2–4 inches long, 5–10 lines thick.

Woods. July to October. Not rare.

Russula obscura Rom.

OBSCURE RUSSULA

Pileus fleshy, convex becoming nearly plane, even on the margin or only slightly striate when old, dark red or purple sometimes blackish in the center, not becoming paler with age, subpruinose on the margin; lamellae, spores, size and stem as in R. decolorans.

Albany, Rensselaer and Suffolk counties. July and August.

The chief difference between this species and R. decolorans is found in the color of the pileus. This is variable but darker than in the typical form of that species and more persistent. The flesh and stem become cinereous or smoky brown.

Russula constans Karst.

CONSTANT RUSSULA

Pileus fleshy, convex becoming plane or nearly so, even or unequally striate on the margin, viscid, pale yellow, flesh white becoming gray with age; lamellae adnexed, whitish or pale yellow, becoming smoky brown or blackish in drying; stem white becoming ashy gray with age; spores, size of plant etc. as in R. decolorans Fr.

Woods. Adirondack region. August and September.

This and R. obscura agree with R. decolorans in their general characters, the most conspicuous difference between them and it being the color of the pileus. This character in many species is not thought to be of specific value, but in these plants the colors of the pilei appear to be constant, nor do they become intermingled on the same pileus as in other species with the pileus variously colored.

Russula puellaris Fr.

YOUTHFUL RUSSULA

Pileus thin, conic or convex becoming plane or slightly depressed, scarcely viscid, tuberculose striate on the margin, variable in color, livid, purplish or yellowish, darker or brownish in the center, flesh white, taste mild; lamellae thin, close, narrowed toward the stem, adnate, white becoming pale yellow; stem equal, soft, fragile, stuffed or hollow, white or yellowish; spores pale yellow, subglobose, .0004 of an inch long, .0003 broad.

Pileus 1–1.5 inches broad; stem 1–1.5 inches long, 2–4 lines thick.

Woods. Albany county. July. Rare.

Var. intensior Cke. Pileus deep purple, nearly black in the center, otherwise as in the typical form. Our specimens belong to this variety. The stem is white and shows no yellowish spots or stains.

Russula pusilla Pk.

SMALL RUSSULA

State Mus. Rep't 50. 1897. p. 99.

Pileus very thin, nearly plane or slightly and umbilicately depressed in the center, glabrous, slightly striate on the margin, the thin pellicle separable, red, sometimes a little darker in the center, flesh white, taste mild; lamellae broad, subventricose, subdistant, adnate, or slightly rounded behind, white becoming yellowish ochraceous with age or in drying; stem short, soft, solid or spongy within, white; spores yellowish, globose, .0003 of an inch broad.

Pileus scarcely 1 inch broad; stem 6–12 lines long, 2–3 lines thick.

Naked ground in woods. Suffolk county. July. Rare.

This is the smallest russula known to me. The coloring matter of the pileus produces red stains on moist paper when the pileus is rubbed over the paper.

Russula flaviceps Pk.

YELLOW CAP RUSSULA

State Mus. Rep't 53. 1900. p. 843.

Pileus convex or centrally depressed, glabrous, covered with a thin viscid separable pellicle, even on the margin when young, slightly tuberculose striate when old, pale yellow, flesh white, taste mild or slightly acrid; lamellae close, narrow, adnate or slightly rounded behind, pale yellow becoming more yellow and dusted by the spores with age; stem equal or nearly so, stuffed or spongy within, white; spores yellow, subglobose, .0003 of an inch long.

Pileus 2–4 inches broad; stem 1.5–2.5 inches long, 4–8 lines thick.

Woods. Sullivan county. August. Rare.

Distinguished from R. citrina Gill. and R. fingibilis Britz. by its yellow lamellae, and from R. lutea Fr. by its striate margin and paler yellow lamellae and spores.

Russula lutea (Huds.) Fr.

YELLOW RUSSULA

Pileus thin, rather firm, convex becoming plane or centrally depressed, viscid when moist, even on the margin, beautifully yellow becoming paler with age, flesh white, taste mild; lamellae narrow, close, free, equal, bright ochraceous; stem equal or tapering upward, soft, stuffed or hollow, white; spores yellow, globose or subglobose, .0003–.0004 of an inch long, nearly or quite as broad.

Pileus 1–2 inches broad; stem 1–2 inches long, 3–5 lines thick.

Woods. Essex county. August. Rare. This pretty species has been found by me but once.

Russula roseipes (Secr.) Bres.

ROSY STEM RUSSULA

Pileus thin, convex becoming plane or slightly depressed in the center, slightly viscid, soon dry, slightly striate on the thin margin, reddish flesh color, rosy red or rosy orange, flesh white or yellowish, taste mild; lamellae equal, close, sometimes forked near the stem, free or adnexed, with a decurrent tooth, whitish becoming yellow; stem equal or tapering upward, stuffed or cavernous, reddish or

white stained with red; spores globose, pale ochraceous, .0003–.0004 of an inch long.

Pileus 1–1.5 inches broad; stem 1–2 inches long, 3–5 lines thick.

Woods. Albany and Saratoga counties. July.

This is by some considered a variety of R. puellaris Fr. The red color of the stem when viewed under a lens is seen to be due to minute red particles or a rosy mealiness.

Russula abietina Pk.

FIR TREE RUSSULA

State Mus. Rep't 54. 1901. p. 180, pl. 7, fig. 1–11.

Pileus thin, fragile, convex becoming plane or slightly depressed in the center, covered with a viscid separable pellicle, tuberculose striate on the thin margin, variable in color, purplish, greenish purple or olive-green with a brown or blackish center, or sometimes purplish with a greenish center, flesh white, taste mild; lamellae narrowed toward the stem, subdistant, equal, rounded behind and nearly free, ventricose, whitish becoming pale yellow; stem equal or tapering upward, stuffed or hollow, white; spores bright yellowish ochraceous, subglobose, .0003–.0004 of an inch long, nearly or quite as broad.

Pileus 1–2.5 inches broad; stem 1–2.5 inches long, 3–5 lines thick.

Under balsam fir trees. Essex county. July and August. Edible.

The species is closely related to R. turci Bres. from which I have separated it because of its paler lamellae and the absence of cystidia from the lamellae and of minute areolae from the pileus and because of the presence of greenish and olive-green colors in the pileus. Its place of growth is only under balsam fir trees, Abies balsamea (L.) Mill., so far as it has been observed.

Russula turci Bres.

TURC RUSSULA

Pileus fleshy, thin, convex becoming plane or centrally depressed, viscid, striate on the margin when mature, reddish violaceous or lilac-purple, darker or blackish in the center, sometimes becoming yellowish in age and minutely areolate, flesh white or whitish, taste mild; lamellae equal, subclose, rounded behind, free, pallid when young, soon ochraceous, interspaces venose; stem equal or tapering upwards, rugulose, soon cavernous or hollow, fragile, white; spores ochraceous, globose, echinulate, .0003–.00035 of an inch in diameter.

Pileus 1.5–3 inches broad; stem 1.5–3 inches long, 3–6 lines thick.

Gregarious; in pine woods. Albany county. October.

The specimens referred to this species were formerly thought to belong to Russula nitida (Pers.) Fr. but they agree much more closely with the description of this more recently described russula, from which they can scarcely be specifically distinct. The plant differs from R. nitida in having no well marked odor and in having neither the pileus nor the lamellae shining. Cystidia are present but they are slightly shorter than in the typical form of R. turci.

Russula chamaeleontina Fr.

CHAMELEON RUSSULA

Pileus thin, fragile, plane or slightly depressed in the center, covered with a viscid separable pellicle, even on the margin when young, becoming slightly striate with age, variable in color, pinkish or rose-red, purplish or lilac, becoming yellow in the center or wholly yellowish, flesh white, taste mild; lamellae thin, close, narrow, adnexed or free, sometimes forked, yellow; stem slender, slightly striate, somewhat hollow, white; spores ochraceous, globose, .0003 of an inch broad.

Pileus 1–2 inches broad; stem 1–2 inches long, 2–3 lines thick.

Woods. Saratoga and Albany counties. July and August.

Russula alutacea Fr.

TAN COLORED RUSSULA

Pileus fleshy, convex becoming plane or centrally depressed, covered with a viscid pellicle, even on the margin when young, becoming more or less tuberculose striate when old, variable in color, red, bright blood-red, dark purple, olivaceous or green, flesh white, taste mild; lamellae thick, broad, equal, subdistant, rounded behind, pale yellow becoming ochraceous tinged with tan color, naked, stem stout, solid, spongy within, even, white or red; spores ochraceous yellow, subglobose, .0003–.0005 of an inch long, .0003–.0004 broad.

Pileus 2–4 inches broad; stem 1–2.5 inches long, 6–12 lines thick.

Woods and groves. July and August. Common.

A large fine species considered edible but I have not tried it. The color of the pileus is so variable that the species is not always readily recognized. From R. integra, which is also variable in the color of the pileus, it may be separated by the naked lamellae and the ochraceous color of the spores.

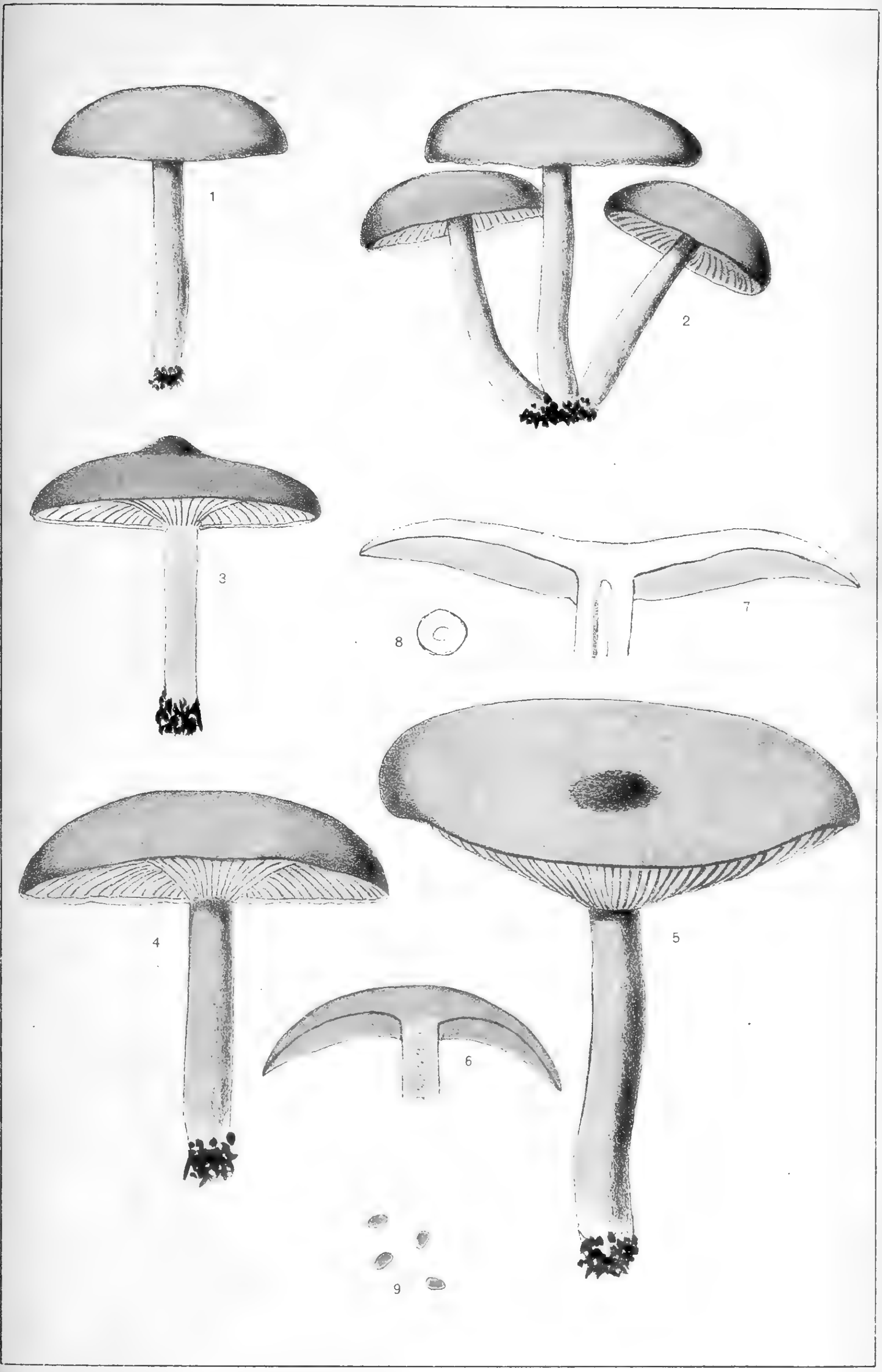
EXPLANATION OF PLATES

PLATE 104

Tricholoma nudum (Bull.) Fr.

NAKED TRICHOLOMA

1 Young plant
2 Cluster of three young plants
3 Young plant with umbonate cap
4 Mature plant with convex cap
5 Mature plant with plane cap
6 Vertical section of young cap and upper part of stem
7 Vertical section of mature cap and upper part of stem
8 Transverse section of a stem
9 Four spores, x 400



TRICHOLOMA NUDUM (BULL.) FR.

NAKED TRICHOLOMA

PLATE 105

Tricholoma hirtellum Pk.

HAIRY CAP TRICHOLOMA

1 Cluster of three plants
2 Single plant
3 Vertical section of cap and upper part of stem
4 Transverse section of stem
5 Four spores, x 400

Russula pectinatoides Pk.

PECTENLIKE RUSSULA

6 Plant with convex cap
7, 8 Two plants with caps fully expanded
9 Vertical section of cap and upper part of stem
10 Four spores, x 400

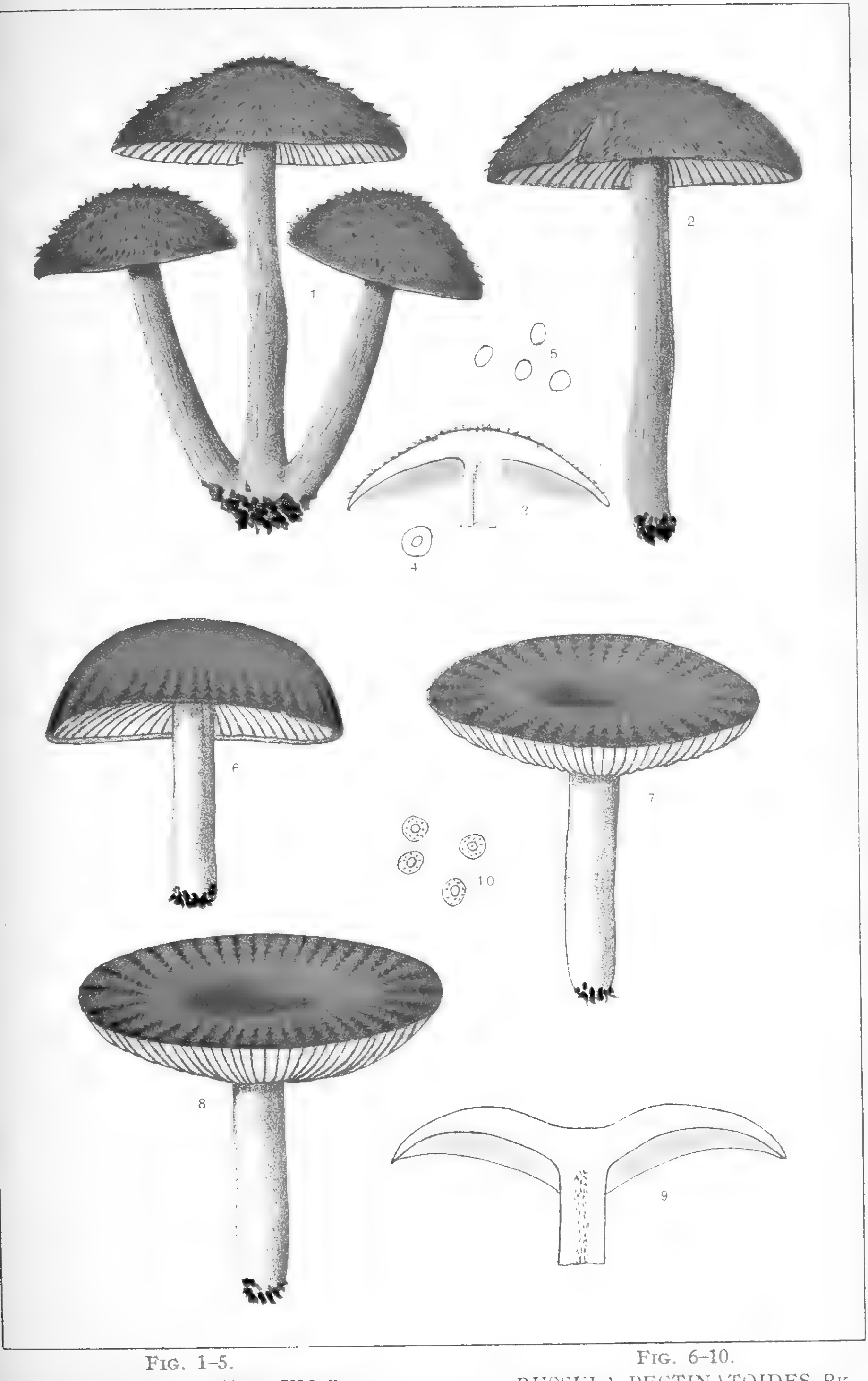


FIG. 1-5.
TRICHOLOMA HIRTELLUM PK.
HAIRY CAP TRICHOLOMA

FIG. 6-10.
RUSSULA PECTINATOIDES PK.
PECTENLIKE RUSSULA

PLATE 106

Clitocybe amethystina (Bolt.)

AMETHYST CLITOCYBE

1 Young plant with moist cap
2 Plant with cap moist on the margin
3 Plant with dry cap
4 Vertical section of young cap and upper part of stem
5 Vertical section of mature plant and upper part of stem
6 Four spores, x 400

Clitocybe ochropurpurea Berk.

PURPLE GILLED CLITOCYBE

7, 8 Small plants with moist caps
9 Plant medium size with dry cap
10 Vertical section of cap and upper part of stem
11 Four spores, x 400

FIG. 1–6.
CLITOCYBE AMETHYSTINA (BOLT.)
AMETHYST CLITOCYBE

FIG. 7–11.
CLITOCYBE OCHROPURPUREA BERK.
PURPLE GILLED CLITOCYBE

PLATE 107

Agaricus micromegethus Pk.

SMALL MUSHROOM

1 Small plant
2 Plant of medium size showing color of young gills
3 Cluster of three plants, two of them large
4 Vertical section of young cap and upper part of stem
5 Vertical section of mature cap and upper part of stem
6 Four spores, x 400

Russula uncialis Pk.

INCH WIDE RUSSULA

7, 8 Two young plants with convex caps
9 Mature plant with expanded cap
10 Vertical section of young cap and upper part of stem
11 Vertical section of mature cap and upper part of stem
12 Four spores, x 400

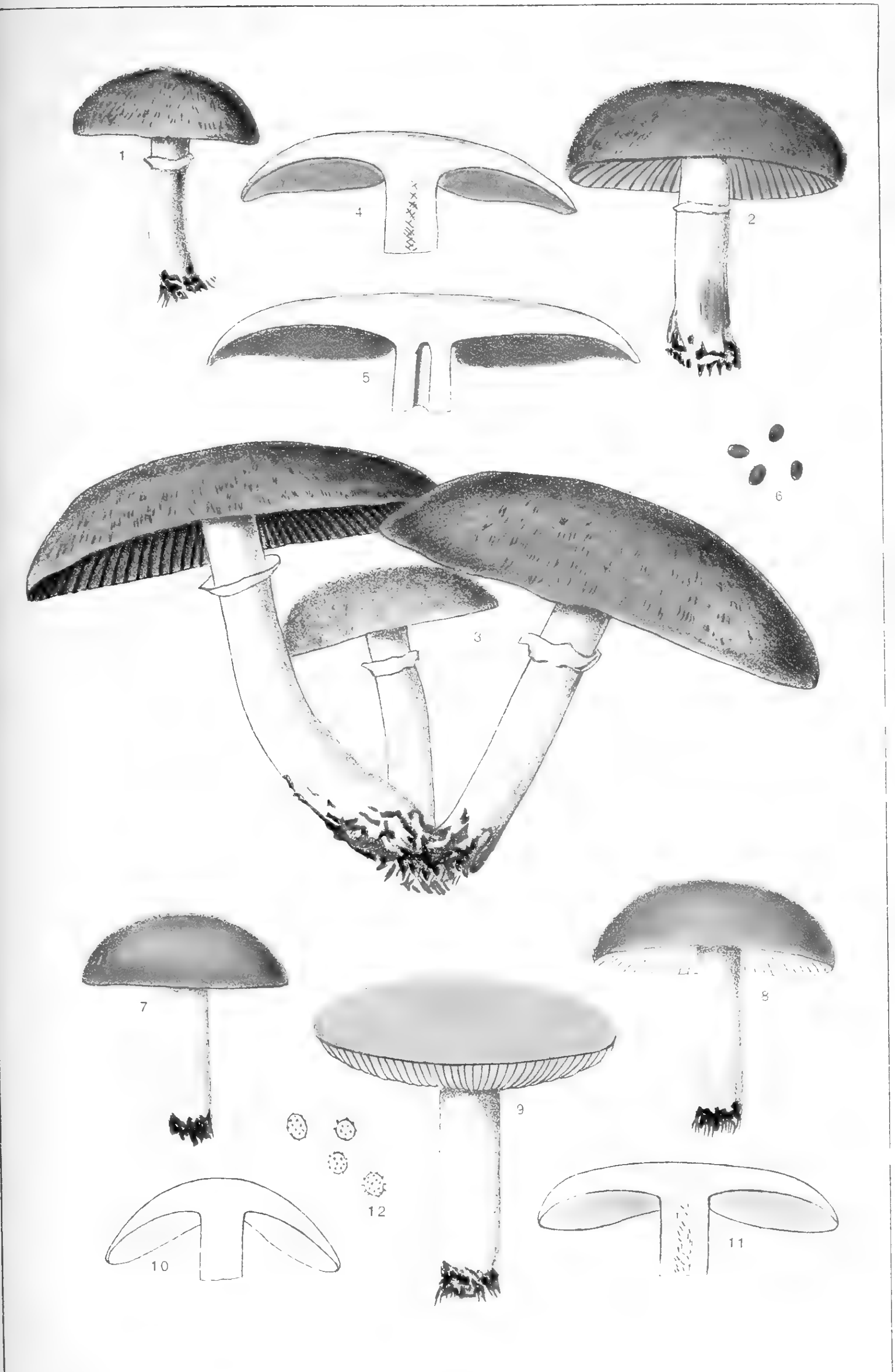


FIG. 1–6.
AGARICUS MICROMEGETHUS PK.
SMALL MUSHROOM

FIG. 7–12.
RUSSULA UNCIALIS PK.
INCH-WIDE RUSSULA

PLATE 108

Boletus frostii Russ.

Frost Boletus

1 Young plant
2 Small mature plant
3 Mature plant of medium size
4 Vertical section of cap and stem
5 Four spores, x 400

BOLETUS FROSTII Russ.

FROST BOLETUS

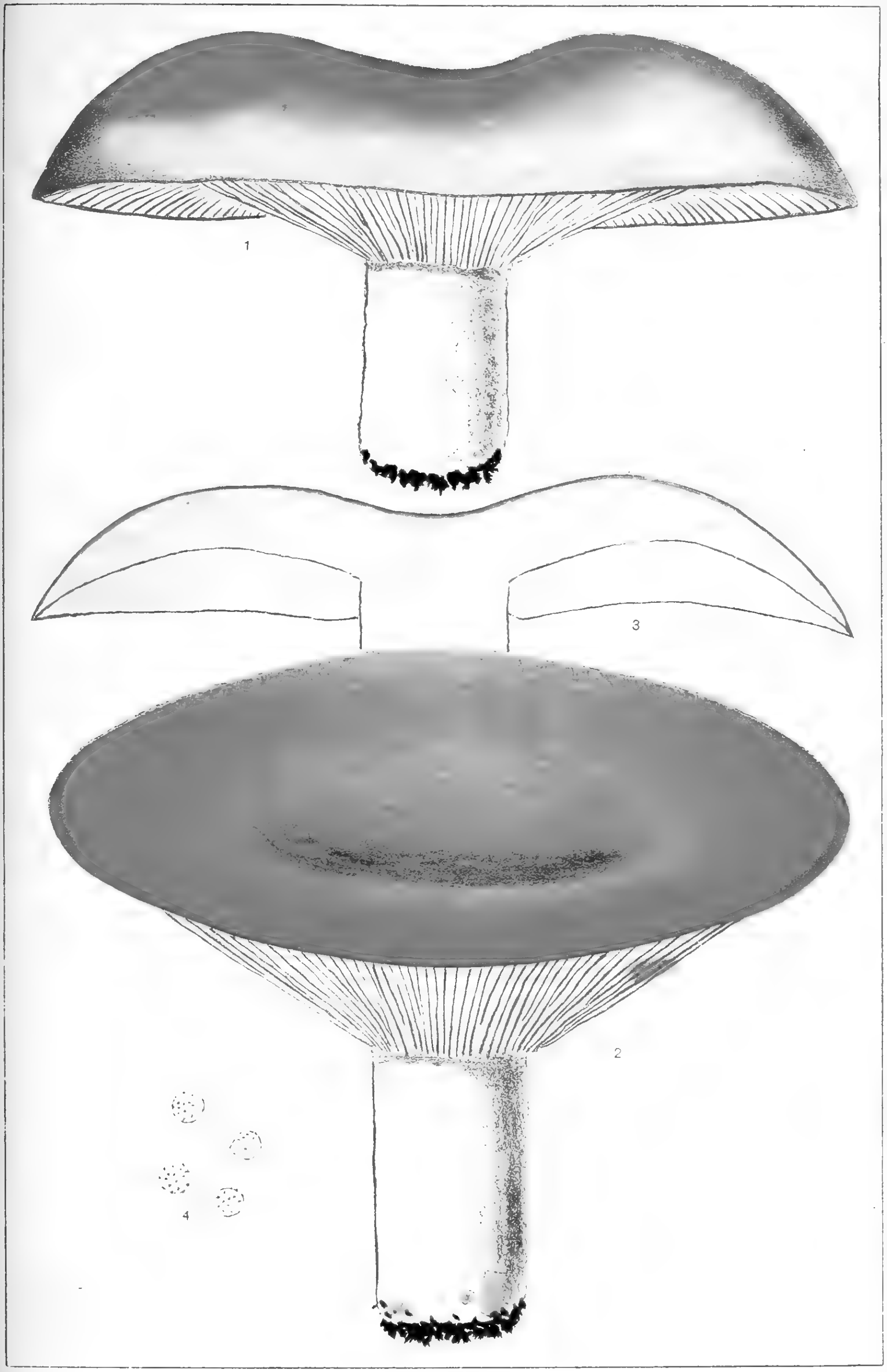
PLATE 109

109

Russula compacta Frost

COMPACT RUSSULA

1 Young plant with convex cap with whitish margin
2 Mature plant with expanded centrally depressed cap
3 Vertical section of cap and upper part of stem
4 Four spores, x 400



RUSSULA COMPACTA Frost.
COMPACT RUSSULA

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New York State Museum

JOHN M. CLARKE, Director

Bulletin 117

ARCHEOLOGY 14

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BEING THE RECORD OF THE STATE MUSEUM ARCHEOLOGICAL EXPEDITION OF 1906

BY

ARTHUR C. PARKER

Archeologist

ALBANY

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STATE OF NEW YORK

EDUCATION DEPARTMENT

New York State Education Department
Science Division, May 24, 1907

Hon. A. S. Draper LL. D.
Commissioner of Education

MY DEAR SIR: I beg to communicate herewith for publication as a bulletin of the State Museum, a report on the archeological expedition of 1906 entitled *An Erie Indian Village and Burial Site* prepared by Arthur C. Parker, Archeologist.

Very respectfully yours

JOHN M. CLARKE
Director

State of New York
Education Department
COMMISSIONER'S ROOM

Approved for publication this 27th day of May 1907

Commissioner of Education

New York State Education Department

New York State Museum

John M. Clarke, Director

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ARCHEOLOGY 14

EXCAVATIONS IN

AN ERIE INDIAN VILLAGE AND BURIAL SITE AT RIPLEY, CHAUTAUQUA CO., N. Y.

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Part 1

ARCHEOLOGY IN NEW YORK

INTRODUCTION

Beginnings of Archeology and Ethnology in the State Museum

In the second annual report of the State Cabinet of Natural History [1849], Peter Wendell, Chancellor of the Board of Regents, said, "In 1847, at the suggestion of the Governor [Young] who had visited the interesting Historical and Antiquarian Museum at Hartford, Ct., it was resolved that an attempt should be made to establish a similar one in connection with the State Cabinet. A circular was addressed to our fellow citizens asking for their aid in furnishing relics of the ancient masters of the soil. The appeal has not been unnoticed. . ."

Thus the State Cabinet almost at its inception became the depositary of "an historical and antiquarian collection." At first this collection was a miscellany of historical and Indian relics, the latter

exhibited merely as curios of the fast disappearing aborigines. To increase this collection and give it a definite value, Lewis H. Morgan was employed to collect such material from the Indians as would be of interest, and the accounts of the Morgan collection contained in the second, third and fifth annual reports of the State Cabinet are without doubt the best descriptions of confederated Iroquois ethnological material of the period 1790–1850 extant.

How little at first Morgan realized the scientific value of his work may be known from his letter to the Regents under date of October 31, 1848, in which he discussed the necessity of the cabinet.

> Such a cabinet would, it is true, contain but little to instruct, would seem but slightly to enlarge the bounds of human knowledge, yet it would be all it pretended,— a memento to the red race who preceded us. . .

Opinion must have suddenly changed, for Mr Morgan three years later, deeply impressed by his contact with the Iroquois, wrote the profoundest ethnographic study of the American Indians ever produced up to his time, and *The League of the Iroquois* yet remains a classic. The scientific world had awakened, ethnology as a distinct science was recognized, and the great work of Squier and Davis, *Ancient Monuments in the Mississippi Valley,* demonstrated that perhaps there was some real scientific value in the "mementos of the red race" and that in the category of natural sciences American archeology was preeminently worthy of a place. Early in the 19th century, however, there was no American archeology or ethnology as we know these subjects now, and therefore there were no *specimens.* Objects were termed *relics* and people interested in relics were called antiquarians. The curiosities which they found in the cornfield when it was plowed were puzzling wonders which caused the finders to invent all sorts of wild theories as far from truth as human imagination could lead. Strange ideas were formed and every new discovery warped to support them. Anthropology at this period took no notice of a flint chip, of a wampum belt, or of a snatch of Indian folk song — it related rather to phrenology and the doctrine of temperaments.[1] Then the works of Morgan, of Squier and Davis and of Prof. (afterward Sir) Daniel Wilson, came before the world, and with those works a new epoch dawned.

When Morgan began his third year's work for the State he seems to have entered it with a new spirit, for at this time, feeling the real

---

[1] The term "anthropology" was first employed in 1501 by Magnus Hundt, of Marburg, and referred to human anatomy.

needs of the cabinet, he secured a magnificent collection and described it at length in the fifth cabinet report, published in 1852. Although Morgan was the one most actively interested in building up the museum Indian collection, others also made valuable contributions in the way of records as well as relics. Notable among these may be mentioned E. G. Squier whose "Ground Plans and Dimensions of Several Trench Enclosures in Western New York," published in the second State Cabinet report [1849], has preserved for posterity a record of a large number of Indian earthworks now obliterated; Franklin B. Hough, who contributed a paper to the third State Cabinet report [1850] with the title, "Notice of Several Ancient Remains of Art in Jefferson and St Lawrence Counties"; T. Apoleon Cheney, who contributed a report on "Ancient Monuments in Western New York," 13th museum report [1860]; Rev. Jacques Bruyas who contributed "Radical Words of the Mohawk Language," published in the 16th report of the museum [1863]. "The Stone and Bone Implements of the Arickarees," by Lewis H. Morgan, published in the 21st museum report [1871] should also be mentioned here.

From the foregoing it will be seen that the State Museum began to form its Indian collections when ethnology as a science was new. The same is true to a degree in archeology. In the early history of the museum, however, the artifacts of the prehistoric aborigines of the State were seldom or never mentioned in connection with the term archeology, but included under the general name of "antiquities." Although the New York Indian museum began before or at the same time when other museums were organized, the active interest in a measure ceased, largely perhaps because no one seemed available to continue field work in ethnology or begin field work in archeology. True, from time to time, articles picked up here and there or perhaps an entire collection were acquired, but only in few cases were accurate data given. While other archeological museums were pushing to the front making great advances, the archeological section of the State Museum fell behind and the collection became what Morgan first thought it would, merely "a memento to the red race which preceded us and but slightly enlarged the bounds of human knowledge."

PRESENT FIELD OF ETHNOLOGY IN NEW YORK

Long before the creation of the State Museum, the Algonkin tribes which once held the southeastern portion of the State had

passed beyond our borders and their descendants, if perchance they may be found, are too far removed in ancestry and from ancient domain and conditions to be able to tell us much of ethnic interest. The Iroquois who held most of the remainder of the territory remain, but during the past 40 years they have been stripped of their ancient heirlooms and treasured relics by collectors who have been silently busy. There will be no more harvests of the old products of Iroquois handicraft — we may only pick up a few scattered specimens that remain hidden in out of the way corners. The State for many reasons has been oblivious to the true conditions and not until 1896 was there an awakening when through the influence of Dr Melvil Dewey, Secretary of the Board of Regents, the following bill was drafted and submitted to the Legislature:

There shall be made as the Indian section of the State Museum, as complete a collection as practicable of the historic, ethnographic and other records and relics of the Indians of the State of New York, including implements or other articles pertaining to their domestic life, agriculture, the chase, war, religion, burial and other rites or customs, or otherwise connected with the Indians of New York.

The trustees of the State Museum shall appoint on its staff a competent curator, without salary, to make and arrange this Indian collection, and for his necessary expenses, and for collecting or buying specimens for the Indian collection, there shall be paid by the Treasurer, on the warrant of the Comptroller, from any money not otherwise appropriated, not to exceed $5000.

The bill was passed and became chapter 586 of the laws of 1896. Then followed the activities of Mr A. G. Richmond who became honorary curator of the collection, and of Mrs Harriet Maxwell Converse. With the appropriation at service Mr Richmond purchased a series of collections from central and northern New York that today can not be duplicated. Among the collections are those of John S. Twining of Copenhagen, N. Y., of Charles F. Moseley of Bergen, N. Y., of William Lay and A. D. Crone of Honeoye Falls, N. Y., of W. S. Stone, Mt Vernon, N. Y., of Dr William G. Hinsdale, Syracuse, N. Y., and of L. Walter Ledyard, Cazenovia, N. Y. Active work in the field was done under the direction of Mr Richmond in the counties of Madison, Onondaga, Montgomery and Fulton and resulted in what is known as the de Clercq collection, from the Messrs de Clercq and Hall who did the excavating.

Mrs Harriet Maxwell Converse manifested her genuine interest by donating as a memorial to her father, Hon. Thomas Maxwell, a magnificent collection of articles of dress, domestic utensils, fabrics

and implements of war and the chase. Her value to the State was at once apparent as her influence and long acquaintance with the New York Indians placed her in a position to obtain from them many more objects of historic and ethnic interest. The articles which she donated and those which she purchased now form a collection of confederated Iroquois ethnological material which stands without rival in any museum, save by that of the Morgan collection within our own walls. It was largely through her influence with the New York Indians that, at the initiative of Secretary Dewey and A. G. Richmond, the historic wampum of the Iroquois were passed over to the keeping of the State. This proposition was placed before the Onondaga nation which after due deliberation passed the following resolutions:

Resolved, That the University of the State of New York be and it hereby is elected wampum keeper of the Onondaga nation, with full power and it shall be its duty to get possession of and safely keep forever all wampums of the Onondaga nation and the Five Nations and Six Nations and each of them.

Thus the University of the State of New York was unanimously elected to the office of wampum keeper.

The following resolution was also unanimously adopted:

Resolved, That the Onondaga nation does hereby sell to the University of the State of New York all wampums for $500, and that the sachems and chiefs present all execute a bill of sale for the nation.

his
[Signed] Say-ha-que Baptist (X) Thomas
mark
and 11 others.

With the passing of the Six Nations' archives into the keeping of the State came their formal presentation and acceptance at Albany June 29, 1898.

The following invitation was sent to carefully selected chiefs, sachems and head women of various tribes.

The University of the State of New York invites. . . as a representative of the Five Nations to attend the exercises of Indian day, June 29, at the annual University Convocation of the State of New York in commemoration and ratification of the appointment of the University as wampum keeper and of the deposit of the wampums in the State Capitol as part of the Indian museum recently established by the Legislature.

[Signed] Melvil Dewey, *Secretary*

Albany, 10 June, 1898

The day was set aside for both the formal opening of the Indian museum and for the ceremonies of presentation and acceptance. Of Mrs Converse's work, Secretary Dewey in his address to the assemblage said:

We have recently had most valuable assistance from Mr Edward Winslow Paige of Schenectady, who as well as Mr Richmond has for years been deeply interested in all that pertains to the Iroquois. Not least are we indebted to Mrs Harriet Maxwell Converse, who early and late has labored for the success of this museum, which will do so much to stimulate public interest in the Indians whom she loves so well, and in whose behalf she hesitates at no labor or sacrifice. With the singular felicity which has so often characterized the Indian names, she bears among the Iroquois, to whom she belongs by adoption, and in whose councils she holds a high and honorable position, the name Yaiewano, which means "she watches for us." Her work, of which it has been my good fortune to know not a little in recent years, entitles her richly to this name.

With the cooperation of such friends and the very judicious expenditure of the small sum appropriated, we have secured a splendid collection, which a few years later no money could buy, as the national and other museums are seeking to add to their own collections anything of so great ethnographic interest as the relics of the famous Six Nations. Among these, like the Sibylline and Doomsday books, infinitely the most precious were the wampums. Their possible destruction, loss or injury was feared alike by the red men and the white men who understood their value, and happily they saw alike that the most fitting place of safety in all the world would be this fireproof Capitol of the State. The proposition found favor and after full consideration was formally adopted by the Onondagas, with whom this responsibility rests, and the original papers constituting the University keeper of the wampums forever have been duly executed with all legal form and deposited in the archives of the State with the wampums themselves, which are exhibited here in the Senate chamber this afternoon.

It seemed to me that such an event deserves some more public recognition and that the members of the convocation who are intrusted with the conduct of the institutions of higher education of this great State would be glad to be present at what is doubtless the last great council of the most famous confederacy known to aboriginal times. It seemed especially desirable that delegates chosen by each of the nations should meet and formally and solemnly ratify the action of the Onondagas in making safe forever the most precious records connected with Indian history. Invitations were issued and sent to all the reservations. Councils were held in due form and delegates were chosen to share in this ratification. Through the courtesy of the New York Central Railroad, special cars were put at the disposal of these delegates. The Albany Historical Society with its accustomed liberality asked to share in the

welcome to this historic city, and provided a dinner for the delegates on their arrival this noon. The Albany City Railway courteously put at their disposal special cars and the senior members of the University staff who met them at the train have acted as their escorts, showing them through the University offices, the State Library, the Indian museum and the chief rooms of the Capitol. Rev. Dr Battershall, rector of St Peter's will extend the welcome for the city, Regent T. Guilford Smith, chairman of the museum committee, who has from the first shown the most active interest in the Indian museum and its welfare, will speak for the Regents. Mr Paige as the lawyer who drew the papers and who has carefully attended to all the legal details, will announce the transfer, and by special request Mrs Converse will speak to us briefly of the Iroquois women, among whom she is proud to take her seat here today. Then we are to hear, as far as time permits, from one or more representatives, of each of the nations.

By the provisions of a law which states that "all scientific specimens and collections, works of art, objects of historic interest and similar property appropriate to a general museum, if owned by the State and not placed in other custody by a specific law, shall constitute the State Museum . . ." the State Museum became the custodian of the wampums of the New York Iroquois. The Director of the Museum thus virtually holds the title of Official Custodian of Records and Wampum Keeper of the Six Nations of Iroquois of New York.

The collections secured by Mr Richmond and Mrs Converse came under the immediate charge of the Director of the State Museum and were installed in cases in the corridors about the western staircase, on the fourth floor of the Capitol. At this time Dr William M. Beauchamp, the well known authority on New York archeology, was engaged to write a series of bulletins describing the implements and ornaments of the New York aborigines and this series, now completed, has attracted widespread interest and has greatly stimulated archeologic research in the State.

With the sudden death of Mr Richmond in 1898, the Indian section of the museum lost its foremost worker. Field work in lines of archeology entirely ceased. Likewise the fruitful work of Mrs Converse which brought to the State treasured ceremonials, the medicine masks, silver crowns, brooches and hundreds of other objects of historic and ethnic interest was soon thereafter closed by death.

Time has slipped by. The Iroquois have become in a measure anglicized. Robbed of their forests and hiding places they have been pushed back in small corners called reservations and have

yielded up through necessity their old-time ways, and the modern substitutes for their ancient usages are often pitiful caricatures. For instance, in the council house upon ceremonial occasion, we find, not the buckskin legging, noisy with rattles of deer hoofs, nor the white doeskin body wrappings, symbolic with colored quill embroidery, nor do regal eagle feathers or white heron plumes wave from chieftains' heads, nor belts of wampum hang from war poles or long wampum strings dangle from the moving hands of speakers. Instead of these things, overalls of blue jeans, gingham jumpers, broad brimmed hats or tattered caps or perchance upon the occasion of the feasts some modern makeshift for the old-time requirements. This exhibition of departed glory is pitiful and pathetic; or if one should say this picture is of the "pagans" only and then not correct entirely, let us look at both "pagan" and Christian Indian upon other holiday occasions. Men, young and old, with kid gloves, stiff hats, stiff collars, stiff shirts, stiff shiny shoes; women, young and old, with kid gloves, feathery hats, rustling petticoats, lace shirtwaists, kid bootees. Some of these ultramodern Indians will not be found on the reservations but out in the strenuous white man's world struggling side by side with the pale invader as college students, teachers, nurses, clerks, accountants, engineers, electricians, newspaper men, athletic trainers, bandmasters, musicians, doctors, philologists, anthropologists and what not. And among these modern people of the ancient Five Nations one must conduct his researches in ethnology, folklore and philology. It is late, far too near the hour when a new epoch will dawn and there will be no more red men as such. Yet in the short time that remains it is our purpose to save at least a part of the tattered fringe of the ancient fabric that was, and from this small part learn something of its entirety. It will be apparent that as far as collecting ethnological material from the Indians themselves is concerned, there is little to be obtained, except slowly and in small quantities.

The purpose of archeology. Specifically, archeology is the science which relates to the conditions, culture and circumstances of prehistoric man. Man is a problem to himself. His remote origin, his ancestry, his early struggles for existence and his evolution are from the standpoint of science, things veiled and obscure. Man struggles to learn the causes which impel him to certain actions, the facts of his origin, evolution, distribution and development, in order to get a better understanding of himself as an individual and as a race. What man was has an important bearing on what man is and

a knowledge of what man is has an immensely important bearing on what man may be. The study of this story of man's development is termed anthropology and may be properly divided into three divisions, present anthropology which is ethnology, historic anthropology which is history or ethnography and prehistoric anthropology which is archeology.

Archeology has definite ends in view far more important than the mere aggregation and description of relics and specimens. What an archeologist finds is never a relic only, although for convenience sometimes termed so. His discoveries are specimens of certain human artifacts illustrative of some stage of culture or of some local development of that culture, and as such, are valuable primarily for what may be learned from them.

To those who are wont to rely upon the written records of history it may not at first clearly appear how much may be learned from such relics or how such things can have the import which the archeologist claims. Let it first be realized that early man has left upon the surface of the earth traces of himself by which his history may be materialized far more accurately than it might ever have been translated from a word-written document. We have become so accustomed to rely upon the testimony of word-made records, that we lose sight of the fact that words are but thought symbols, *ideaphones,* and ideographs, and that written records may be erroneous and incomplete while material objects may convey clearer meanings by which a much more accurate knowledge may be gained. We seek to know the man of prehistoric times, yet that man has left us few written documents by which we may read in words his thoughts and learn of his activities. He has done better, and we may know him notwithstanding. He has left pencilings upon the surface of the earth which he trod which neither rains, nor floods, nor the ravages of time have erased, save in spots, as a stray raindrop might expunge a letter from a slate and yet leave the word still readable. For example, take the fire pit by which the ancient warmed his body and in which he cooked his meat, into which he cast the bones he could not eat and swept the refuse of his bower. That fire pit remains to this day to tell the story of the man who dug it. By the relics found within it, it tells us what he ate, what he wore, what trinkets he had, the beasts he killed, the weapons he used, how far advanced he was in the arts, how much and where he commerced, what grains he cultivated, what implements he made of stone and bone and shells and clay and of the fabrics he wove from

roots and grasses. We may even read his thoughts in his artifacts and know his sense of beauty and of accuracy, we may learn of his superstitions and personal habits and more things than these. None of his day left us the written record by which we know these things, but if by strange chance the wild raw story of man primeval or of his early descendants has been written on a parchment by his contemporary, it would have been destroyed by the accidents of time, or if it escaped, been laughed at as a legend; if preserved in symbols wrought on rock walls the crude ideographs would be unintelligible mysteries to the people of the later day. The age of stone in the State of New York has left nothing in the way of inscriptions by which the wondering steel age of now may know of it. It is better that it has left us in its fire and refuse pits, in its graves, in its monuments and earthworks a record far more satisfactory, enduring and truthful.

THE FIELD OF ARCHEOLOGY IN NEW YORK

During the past 20 years tremendous strides have been made in archeology. Museums have been especially active. Questions that seemed incapable of solution have yielded to careful investigation.

Museums and collectors have found New York a most fertile field for archeological research and for years have carried beyond our borders thousands of specimens.

With the creation of the State Education Department and the installation of the present Director a new policy was instituted. An archeologist was engaged to examine the prehistoric and recent monuments of the aborigines and by exploration and excavation to obtain first-hand from original sources specimens to illustrate the facts of that occupation, to discover the various cultural areas and to collect from the Indian tribes yet residing in the State such material as should be properly contained in the museum series. The outcome of this policy has been the creation of the position of archeologist on the Museum and Science Division staff.

As a field for archeological research New York State presents one exceptionally inviting. Specimens discovered in different parts of the State evidence a number of distinct ethnic cultures of great interest. The various problems connected with these culture regions will form the subjects of special research. Nor will conclusions be formed hastily. Several years of active field work in each district will be done and the results embodied in reports or special bulletins.

Prehistory is our primary object. We intend if possible to bring into the intellectual grasp of the men of today the life and conditions of the various peoples who held the Empire State before us. To attain the highest results the cooperation of every citizen interested in history and archeology is invited. Information as to the localities of aboriginal occupation is highly desirable. Donations of collections accompanied by as complete data as possible are especially sought. It is our desire to keep in touch with every one interested in New York archeology and ethnology and any correspondence upon these or kindred subjects will ever be welcome.

SOURCES OF INFORMATION

In New York State we may expect to obtain archeological data principally from the following named sources:

I GENERAL AREAS
- 1 Inhabited areas
  - *a* Village sites
  - *b* Camp sites
  - *c* Shell heaps
- 2 Defensive works
  - *a* Fort rings
  - *b* Fort hills or points
  - *c* Palisaded fort sites
- 3 Places of industry
  - *a* Workshop sites
  - *b* Quarries
  - *c* Garden beds
- 4 Places for disposing of the dead
  - *a* Cemeteries or burial grounds
- 5 Places of conflict
  - *a* Battlefields
- 6 Routes of traffic and travel
  - *a* Trails
- 7 Occasional or rare places
  - *a* River gravels
  - *b* Drift deposits
  - *c* Swamps
  - *d* River and lake bottoms
  - *e* River and lake shores
  - *f* Ceremonial districts and areas

II PARTICULAR PLACES

1 Sites of dwellings
- *a* Lodge sites
- *b* Caves and rock shelters

2 Refuse deposits
- *a* Fire pits
- *b* Refuse pits
- *c* Refuse heaps
- *d* Shell heaps
- *e* Signal light ash deposits

3 Monuments
- *a* Mounds
- *b* Cairns
- *c* Inscribed rocks
- *d* Council rocks

4 Burials
- *a* Graves
- *b* Ossuaries

5 Places of industry
- *a* Kilns
- *b* Individual workshops

6 Places for storing or hiding things
- *a* Caches of implements finished, general
- *b* Caches of raw material, general
- *c* Individual caches

7 Ceremonial places
- *a* Springs
- *b* Spots

DESTRUCTION OF SOURCES OF INFORMATION

Many of the most valuable sources for archeological research have been forever lost to the State and to the scientific world in general. Mounds and earthworks have been destroyed and leveled through the necessities of a commercial civilization that has taken little heed of things archeologic. Railroads and canals have cut through ancient sites and have thrown the priceless relics of aboriginal art in with the common dirt to be used for roadbeds or for grading; farmers, not realizing their vandalism, have scooped down earth walls and mounds to level their land for agriculture; manufactories, towns and cities have been built over the site of Indian villages and burials, and not less lamentable has been the work of ignorant col-

lectors who with a single passion — a greed for relics — have spaded over sites, overturned mounds and desecrated graves, merely to gratify their desire to find some new curiosity and add it to their collection. Such collectors have seldom preserved in writing the circumstances of the find or even the most meager information, and their collections are usually only a heap of stones almost worthless scientifically except as an exhibition of some indefinite Indian art. More enlightened collectors, realizing the differences in culture in different regions, and bearing in mind the various problems of American archeology have done their work conscientiously and with care, preserving a record of their finds, and are to be commended for their work, especially when they have finally placed their collections in the keeping of some scientific institution where its value would be appreciated. The breaking up and scattering of a collection is the breaking up and destruction of just so much knowledge. With the increase of population and the growth of towns many more sites will be obliterated and their value lost forever. It is therefore for us of today to rescue and preserve, while there is yet time, for the people of tomorrow the prehistory of our State and to secure for it the relics of that prehistory.

METHODS OF COLLECTING ARCHEOLOGICAL MATERIAL

Assuming that a given territory was inhabited anciently there are two ways of discovering and preserving the circumstances of that ancient occupation. The first method is to collect and study its traditions, and the second is to make a systematic study of the visible relics of that occupation. While traditions may not always be truthful, they are not without a certain value. Often they furnish clues that lead to important discoveries. Often a discovery substantiates a tradition or a tradition explains the presence and use of certain things peculiar to a region. If a tradition is entirely without foundation in fact it is still interesting for it reveals what men assumed or affected to be true.

The second method by presenting actual objects from which conclusions may be drawn is the more reliable and universally so recognized by modern archeologists.

Archeological material is collected for two distinct purposes; first, to increase knowledge, and second, to illustrate and diffuse knowledge.

Three methods of accomplishing these objects are employed by people or institutions interested in archeology. The first method,

the most primitive, is the collecting of relics secured in a casual way, and since it aims simply to amass the various objects used by the early races for preservation, it may be called the *preservation method.*[1] Inasmuch as the objects are secured by those unfamiliar with the requirements of scientific archeology, it is natural that they should be those most attractive to the eye, the less striking things being passed over as unworthy of preservation if not overlooked entirely. This method, now obsolete in progressive institutions, is one that has been employed by people with whom collecting was only an incident or by historical societies that have sought to add archeological material to their collections of antiquities. The second method, called the *synoptic method,* is a systematic attempt to procure in any way specimens to illustrate the known facts of archeology. The third method is termed the *research method.* By this method the archeologist aims to obtain material first-hand from original sources, such as mounds, camp and village sites and earthworks of various kinds. Such sites are carefully and systematically excavated and all the accompanying objects secured. Painstaking records are kept and every fact that might be of value noted in record books. The methods employed in the field by the State Museum exemplify the workings of this system.

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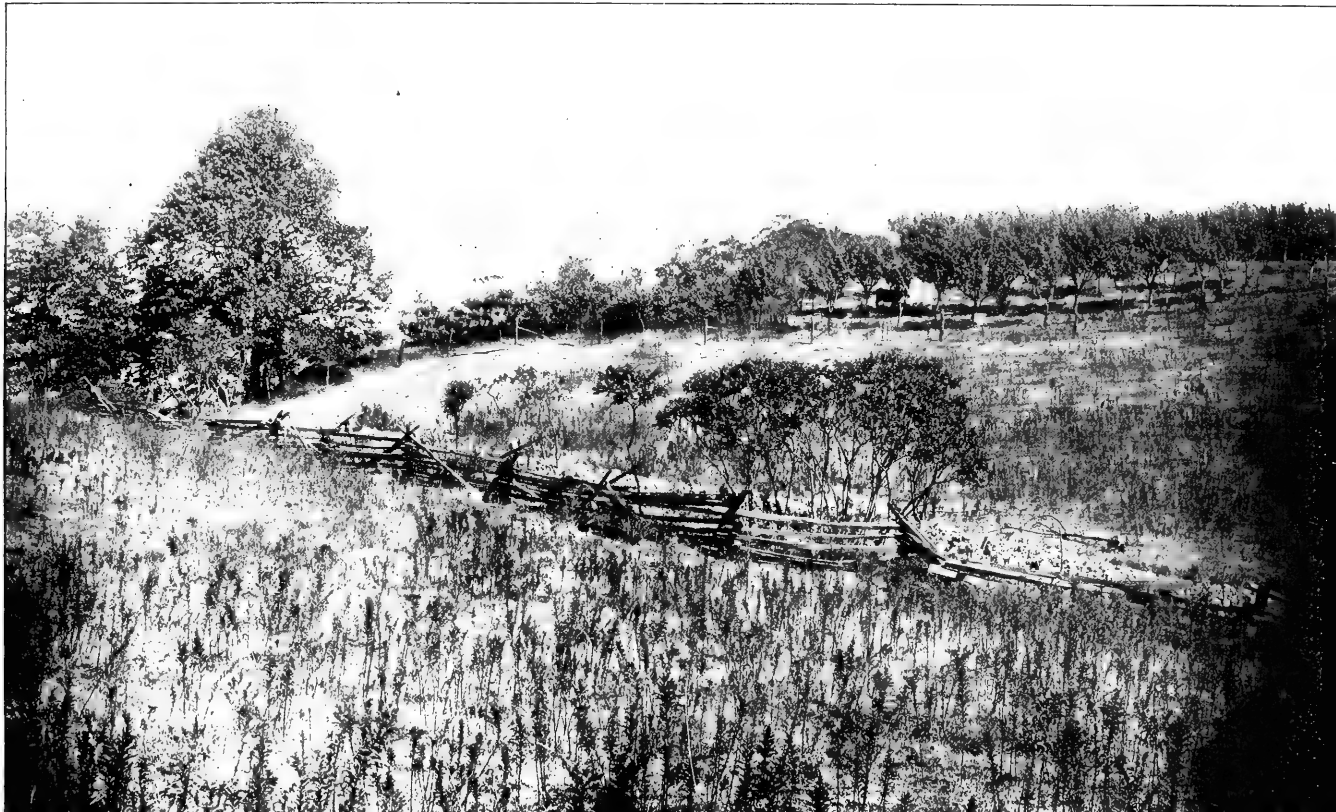
[1] For this nomenclature the author is indebted to *Methods of Collecting Anthropological Material,* by Harlan I. Smith.

Plate I



View looking northwest over Dewey Knoll toward Lake Erie

Part 2

RECORD OF EXCAVATIONS AT RIPLEY

A foreword

It is not designed in this account to present an exhaustive treatise on the Eries or of the various classes of objects discovered. Our purpose is merely to set forth an account of the work as it was done and briefly describe the specimens found in the course of exploration, adding such supplementary matter as may be of immediate importance for a proper understanding of the operations and the results. The record of this expedition with those which have preceded it and those which follow in the Erie region will form the base of a special work on the Eries and in that work the various Erie sites in New York and Erie artifacts will be fully discussed. This account, therefore, is to be regarded as a report of progress rather than as a complete and final treatise.

General region

Along the southern shore of Lake Erie between Westfield and State Line, and extending east and west from these points, is a high bluff of Chemung shale rising almost sheer from the water. In various places it is from 15 to 65 feet above the lake level. It forms a most effectual barrier to those who might wish to reach the land from the water or the water from the land. The soil above the shale in general is a loose water-washed sand and gravel beneath which is a substratum of Erie clay which outcrops at denuded places. In this lake border region are numerous springs and brooks. Two miles back from the lake rise the steep Chautauqua hills which form the watershed that sends the streams on the south into the Allegheny and its tributaries and finally into the Gulf of Mexico and those on the north into Lake Erie and finally into the Gulf of St Lawrence. This region by reason of its physical features afforded an ideal retreat for the tribes of men who found their way there after the subsidence of the great glacial lakes, which receding left their shore lines far inland as terraces and hills and their beds as fertile undulating plains.

Traces of early occupancy are found here. On the sites of ancient marshes are found the bones of the mastodon and with

them fire-cracked stones and charcoal, evidence, it may be, of man contemporaneous with the American elephant. There are sites which yield the monitor pipe, others that yield the polished slates called banner stones, gorgets and bird-shaped stones and the notched flints far different from the flints shaped by later comers. That the people who made these things were of the American race is evident, but of what tribe or stock is a question yet to answer. Neither is there yet any way of discovering who their descendants of today are, if perchance their blood yet flows in human veins at all. At a later period a new stock of people invaded the region but whether they found it inhabited or whether there was a struggle in which the old race was expelled is merely a matter of conjecture now. Evidences of the wide distribution of these old people seem to preclude the theory of their utter extermination and it seems more probable that they became absorbed by their conquerors or became expelled to regions where their environment changed their culture.

The later invaders who displaced the builders of the mounds and makers of polished slate implements seem to have been some early branch of the Huron-Iroquois family. Their territory is characterized by the earth walls and inclosures which they left and by the pottery and triangular arrow points which are never found on earlier sites untouched by other occupations. The early Iroquoian sites are still further differentiated by the ossuaries which are found upon many of them. Later this territory came into the possession of a people whom we recognize as the Eries, a branch of the Huron-Iroquois, but a people whose culture differed from the earlier Iroquoian peoples of whom they are without doubt the descendants. After the expulsion of the Eries in 1654 the region remained uninhabited save by wanderers and hunters and not until after the Revolutionary War did it become the hunting grounds of the Senecas who had trails through it, one of which passed close to the Erie site at Ripley. Over this trail the Senecas for years traveled on their way to the settlements on the Sandusky in Ohio. Another great trail extended down what was once the Portage road to Chautauqua lake. It began at Barcelona harbor.

There have been noted numbers of sites of aboriginal occupation east of a meridian line drawn through Chautauqua lake and touching Lake Erie on the north and the Pennsylvania line on the south. West of this line, from the archeologist's standpoint, lies a practically untouched region, a strange fact since it presents an exceptionally inviting field for investigation, being as it is, the borderland between the territory of the tribes of Iroquoian stock and the

culture region of that mysterious people for the sake of convenience termed "mound builders."

RIPLEY SITE

For a number of years the writer had known of a site in this locality, one on the lake shore 2 miles northwest of Ripley, but until this season had not had occasion to visit it. In 1900 it was reported to Mr. M. R. Harrington and the writer by Prof. John Fenton, when we were assistants on the archeological staff of the American Museum of Natural History. Mr Harrington did some work on the site in 1904 for the Peabody Museum of American Archeology and Ethnology, but, because of various obstacles, left the major portion untouched. The excavations which he made during his short stay revealed the fact that the site was a most prolific one. In view of the fact that the State Museum of New York had few or no specimens of the Erie culture, and, indeed, as very little was known of this culture, the site was chosen as the field for the season's operations and a leasehold obtained. The Ripley site is situated on the William and Mary Young farm in lot 27, Ripley, Chautauqua county. It covers an elevation locally known as "Dewey knoll" situated on the cliffs of Lake Erie. On the east a stream has cut through the shale and eaten down the bluffs to the lake level so that a landing is easily effected from the water. This landing is one of the few between Barcelona harbor and the mouth of Twentymile creek in Pennsylvania where there is easy access to the land on the bluffs above. The stream has cut the east side of the knoll so that for several hundred feet south from the lake the bank rises steep and in places almost sheer from the creek bed. The place is one, therefore, naturally adapted for a fortified refuge and must have been an attractive spot indeed for the aborigines who built upon it a village, a circular earthwork and who found in the soft sand a most suitable place for the burial of their dead.

Surface features of the site

The site was found to be mainly on the level top of the knoll although a number of graves were found on the south and west slopes. The "unoccupied soil" began at the lake bank and ran back inland to the southern slope. The soil bordering the bank line was a light sandy loam heavily intermixed with carbonaceous substances, animal phosphates, vegetable mold and particles of animal bone. Back to the south it was generally a light shifting sand which rested upon a more compact stratum. At places, especially a few feet

down the slopes, the clay stratum outcropped. Here the soil was bare or only sparsely covered with grass.

The entire knoll was covered by a peach and plum orchard (since uprooted) and it was between the rows of trees that work was carried on. The owner naturally objected to carrying the excavations too near the roots and thus it was sometimes impossible to take out a skeleton or to open a pit when it lay beneath a tree. In such cases slanting shafts were sunk beneath the roots and the pit examined. This was a somewhat dangerous operation as sometimes the overlying sand would cave down and engulf the curious but incautious archeologist who after a time would be rescued by his assistants.

Preliminary post holing over the knoll soon revealed the character of the site, and in consequence it was divided into two sections, the village and the burial. Parallel and adjacent trenches were staked out and the lines run as far as post holing and surface indications revealed a disturbance or modification of the soil by its former occupation.

Surface evidence of an occupation

The surface evidence of an occupation in that portion of the site afterward found to be the village section was pronounced. The ground was strewn with heat cracked stones, fragments of shale anvils, broken flint nodules, with here and there a fragment of weathered pottery hidden amongst the roots of the tall grass. The luxurious growth of grass in patches when surrounded by a scantier growth points out a spot of soil enriched by some abnormal agency. The rank thick grass and clover here in the village site was conspicuous and pointed out the presence of occupied soil or "Indian dirt" as archeologists sometimes term it. Except on the western slope, the burial section of the site revealed no trace of its character. On this hillside where the elements had washed down the loose sand some of the graves were left so near the surface that the skeletons had been thrown up by the plow. The broken and crumbling bones, however, would hardly be recognized by the ordinary observer as human remains. Other than the bits of human bone on the surface there was no external indication where graves were located, unless it were conjectured that if graves were to be found at all they would be in the soil most easily excavated.

Village section

The village section occupied the level top of the knoll bordering the lake bank and ran back south on the west side about 200 feet

Plate 2

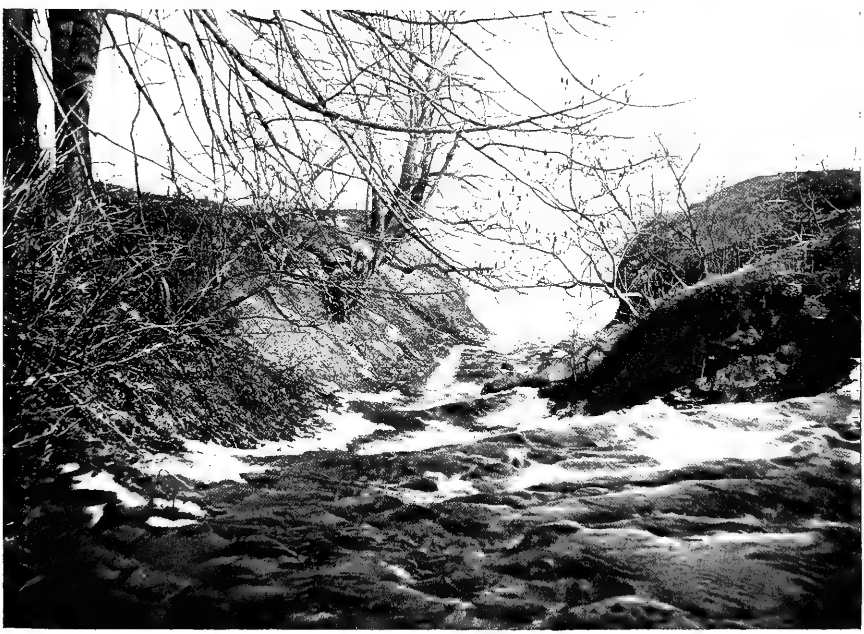


Fig. 1 Looking over the northeast side of the knoll. Access to the land from the lake is from the mouth of the creek

Fig. 2 View over the falls looking toward the mouth of the creek and the lake

and on the east side to the declivity that formed the bank of the eastern hillside. This bank ran at nearly right angles to the knoll proper, the whole eastern slope forming an arm that sloped down to the level just above the creek. On the southern bank of this arm were refuse dumps. The east arm was post holed at intervals of a rod, 220 holes being dug. Hardly a sign of occupancy was found except near or along the level. There was no "occupied soil" or "Indian dirt," the soil being in general a stiff clay mixed with sand and gravel and much more compact than the top soil on the level.

An examination of the surface of the village site led to the discovery of a circular earth belt, a part of which was cut off by the

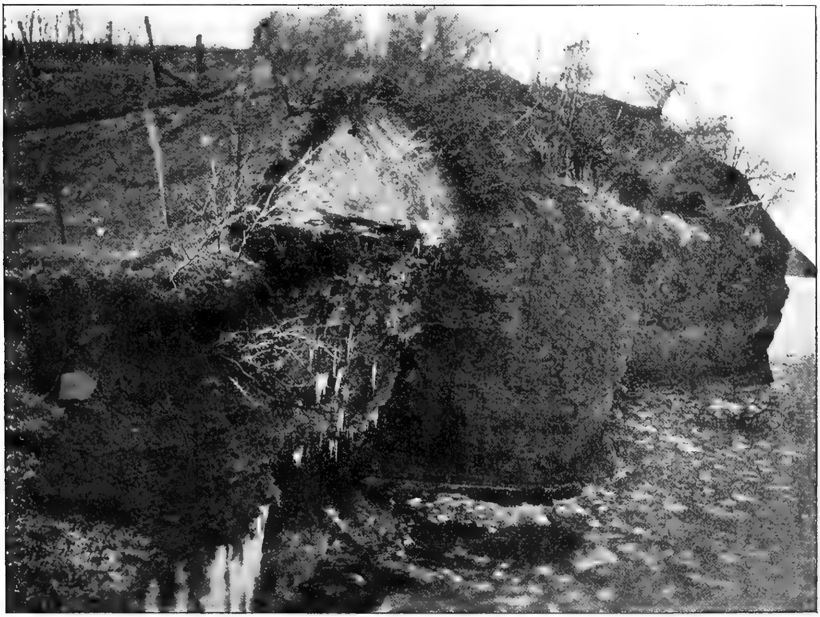


Fig 1 View of cliffs at northeastern end of the village site. Every year as the frost and water wear down the shale the earth above slides down into the lake exposing pits and relics. A recent landslide is shown at X in the picture.

lake bank. On either side of this earth ring were pits and occupied soil. The signification of this belt is discussed hereinafter under the title "Significance of some of the data."

Diminution of the village plot by the encroachment of the lake

It is highly probable that most of the village site has been lost by the encroachment of the lake, which eating down the shale cliffs caused land slides [text fig. 1]. Certain it is that land is lost in this

way each year. The belief that a part of the occupied area has disappeared is strengthened by the fact that this section is small in comparison with the rest of the site, by the fact that the occupied soil exposed at the bank is deep, by the fact that the bank line intersects a part of the circumference of the circular earth belt and by the fact that the exposed bank shows all along the level top the exposed occupied soil and pits. It is probable that originally there was considerable space between the shore side of the circle and the bank and that a part of the village occupied that space. Village sites upon hills generally extended to the edge of the declivities and if we can establish where the bank line was at the period of the occupation we may say how far the village probably extended. To establish accurately this line is a difficult matter but inquiries led to the information that from 6 inches to a foot of land was lost each year. Using this assumption as a datum we may hypothecate that the site has lost at least 150 feet since the time of its occupation. The date of this occupation is discussed elsewhere.

Method of excavating in the village section

The village section was staked out in parallel and adjacent trenches 16 feet wide. Excavations were commenced at the wire fence 20 feet from the shore line. A sectional trench 3 feet wide was dug and the dirt thrown back. This left a cross-section of the trench exposed and the 3 feet of floor served as a working space. The archeologist examined this cross-section and if indications pointed to the probable presence of objects he troweled into the bank, allowing the earth to fall to the floor until it had filled when it was removed by a laborer. If the indications pointed to a barren spot the workmen spaded ahead until signs of disturbance again appeared when the section was again examined. When a pit was discovered a clean working space was made and the pit vertically exposed at one side. The pit filling was then troweled from top to bottom, great care being taken not to break the specimens that might come to light with any trowel stroke. As the work progressed measurements of the pit were taken and all the important specimens labeled and placed in trays for subsequent numbering. The refuse material such as animal bones, potsherds, flint chips and rude implements were placed in labeled bags. A diagram of the pit was drawn and the details of its excavation recorded in the trench book. Trenching was continued until the trench became barren when another trench was worked.

Every pit, pocket or post hole was charted, the varying character of the soil and the manner of its disturbance was noted and it is possible for any one familiar with our methods to take a specimen from the collection and after examining its number and referring to the records, point out on the map or on the actual site itself exactly where that object was found.

To insure accuracy in field records, three of a different kind were made, so that any circumstance omitted in one might be found in one of the others. The first record was made in a "trench book" and written as the actual work progressed; the second record was made on data slips and supplemented the trench book in the matter of measurements, locations, positions etc. of trenches, pits and objects, and added the details of the particular thing described on the slip; the third was a survey record, in which every pit, grave or trench cutting was charted to a degree of mathematical exactness. All these records are supplemented by drawings, diagrams, maps and photographs.

Method of excavating graves

The burial section was staked out in the same manner as the village section. The workmen in excavating removed the disturbed top soil for a distance of 3 feet leaving a working space of 3 feet by 16. Excavations were continued until signs of deeper disturbance appeared. These "signs" were foreign substances in the regular strata, such as fire-burned stone, flint chips, charcoal and lumps of clay. Earth of the character here found once disturbed is never as compact again as originally and even if there were no intruding substances in the sand its very looseness as distinguished from the rather compact sand surrounding it was a sign of its disturbance. The top soil over the grave was removed and its outline ascertained. The superincumbent earth was removed for a foot, and a depth of 6 inches below explored for signs of the grave bottom, and if not found the earth for another 6 inches was shoveled out with great care, the shovel scooping up the earth rather than spading into it. The trowel was used again to dig down and the process repeated until the skull or pottery vessel top was reached. The soil was then removed carefully with trowels. The skeleton and grave bottom were cleaned with fine pointing trowels and finally swept with a brush, care being taken not to move any bone or other object in the grave. A diagram of the grave and its contents was made, the exact position of these objects

ascertained by means of a compass and tape. The dimensions of the grave, its number and position in the trench and the character of the soil and other items of importance were recorded in the field book. If the burial was of sufficient interest photographs from one or more positions were made. The skeleton when removed was wrapped in excelsior or cotton and placed in a labeled box but not finally packed until dry. The objects found in the grave were placed in a tray with a proper label and afterward marked with the serial field number, this number being distinguished from the museum serial by prefixing the letter "F." Data slips numbered to correspond with the specimens were filled out and give all the necessary details. Any information not found on the slip may be found in the field record. The various records thus countercheck each other.

Extracts from the trench book describing the pits in the village site

The trenches in the village plot began at the wire fence that ran parallel to the edge of the alluvial cliff and 20 feet from it to the south. No excavations beyond a few post holes back of the fence along the bank were permitted by the landowner who believed that should the sod be broken and the bushes uprooted the earth would slide down the bank and thus the loss of his land would be unduly accelerated.

Pits in the village site

Pit 1, trench 1 at 5′ on the east side was a refuse pit evidently filled with the sweepings of the lodges that were near it. The pit was circular, 8′ in diameter and 42″ deep. It contained the split and cracked bones of deer, bear, elk, beaver, various fish and birds and also fragments of the shells of Unio complanatus. In the pit soil among the refuse of fire-broken stones, charcoal and ashes were 9 bone beads, that is, polished sections of cylindrical animal or bird bones. The pit filling was an almost uniform black from top to bottom where there was a yellow clay-mixed sand through which the pit soil had not drained. In most pits the soil at the sides and beneath is ramified by worm and rodent holes which have allowed the black carbonaceous pit matter to percolate to a depth often much greater than the original pit bottom. For this reason pits often appear much deeper than they originally were. Here, however, there was a sharp line of demarcation between the modified pit filling and the undisturbed bottom beneath.

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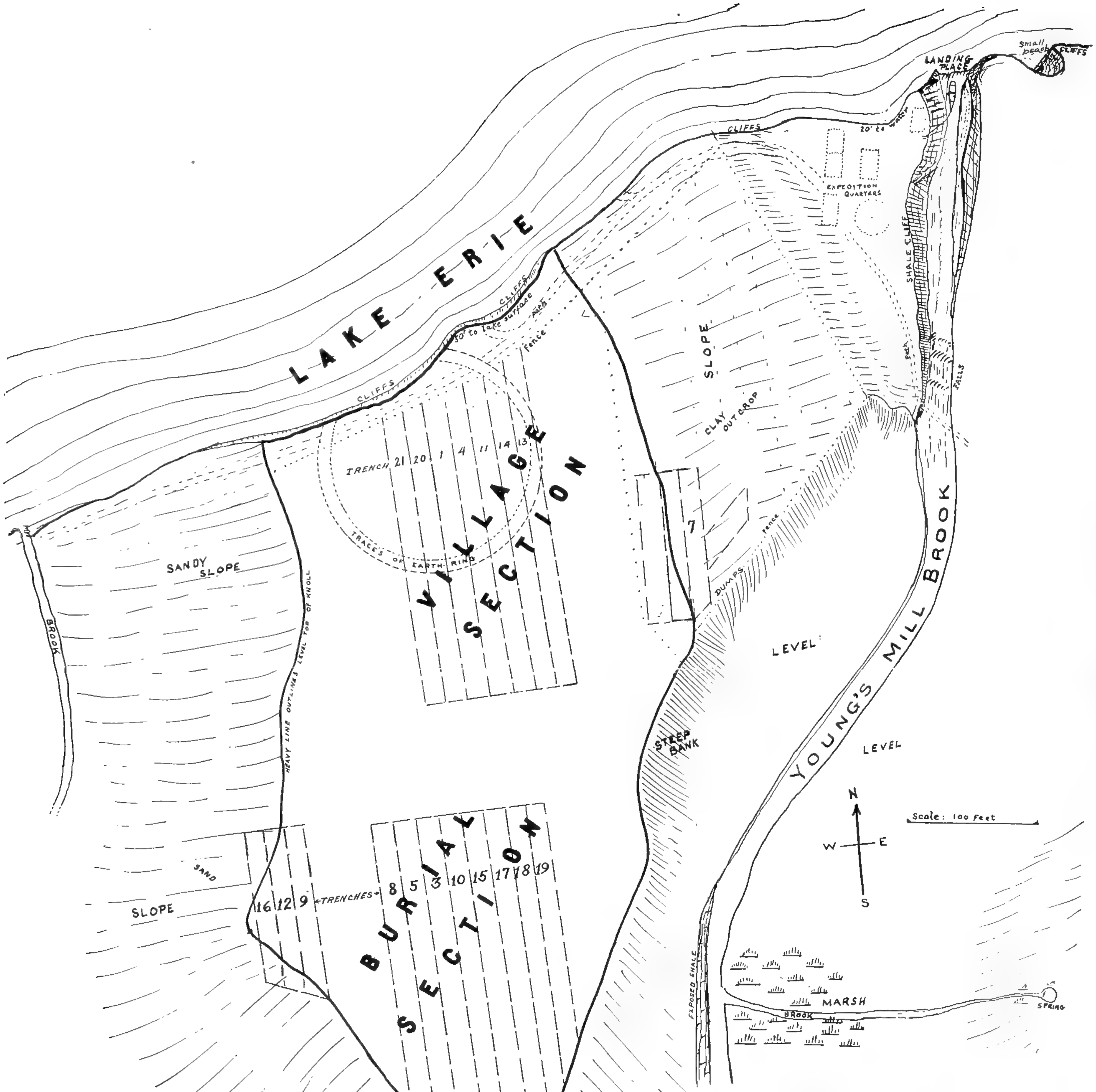
Plate 3



SKETCH MAP OF THE ERIE INDIAN VILLAGE AND BURIAL SITE ON THE YOUNG FARM, RIPLEY, N.Y.

BY

ARTHUR C. PARKER

Pit 2 was discovered just south and west of pit 1. It was a circular depression 10′ in diameter and 4′ deep. It was a solid pit, that is it was not divided by layers of sand or other substance different from the general pit filling. The soil was a uniform black from its admixture with carbonaceous matter. There were numerous fire-broken stones in the pit, also animal bones, flint chips and potsherds. The implements found in this pit are 2 rude bone awls, F259, 256, 5 tubular bone beads, 1 finely formed bone awl, F269, 2 "jewel" bones from the head of a sheep-head perch, F290, 291.

Pit 3 in trench 1 at 16′ in the middle was 12½′ in diameter and 37″ deep. It was separated from pit 1 by a rather hard layer of topsoil as if this area had not been disturbed until much later than the other trench layer. This area was bounded by pits 1, 2 and 3 as may be seen by consulting the map and possibly was a lodge site.

At 12″ from the surface standing upright with the point down was an antler chisel or pick [*see* pl. 35, fig. 4]. The handle or blunt end seemed to have been cut with a metallic blade. Three bone beads, F261, 262, 263, were found lying in the bottom of the pit end to end. Three others were discovered at 12″ beneath the surface but separated. Near the pit bottom was a bone awl, F271, an arrow point of the long narrow type sometimes called fish points, F267. At 18″ below there was a shell bead of the old type, F289 [*see* pl. 36, fig. 6].

Pit 16 in trench 1 was at 36′ in the middle and was the next pit in the trench after pit 3. Between these pits there seems to have been a lodge site because there were a number of post holes that seemed to outline one. The top dimensions of this pit were 4′ by 5′ and the depth 24″. The pit was divided into two strata, the dividing stratum being a layer of sod soil 2″ thick. The upper stratum contained a quantity of deer and fish bones, potsherds and a few fire-broken stones. At 9″ below the surface, just below plow depth, was found a portion of a copper wrist band [*see* pl. 37, fig. 4]. Near it was a rude bone awl. The copper bracelet was the first indication of European contact found in the site.

Pit 17, trench 1, at 35′ on the west was separated from pit 16 by a distance of about 2′. It was 3′ by 4′ in top dimensions and 24″ deep. It contained some large potsherds and pieces of decorated rims. Near the bottom was a small pottery vessel having high raised points at opposite sides, F298 [*see* pl. 28, fig. 3]. Beneath it was the complete skeleton of a fish. At one side of the pit was

a deposit of nearly a quart of Helix alternata and albolabris shells.

Just beyond this pit in the general occupied layer, 10″ below the surface was found a hand-hammered nail bent in hook shape. The nail was perhaps intrusive though its shape suggests aboriginal use.

Pit 18 on the east side of trench 1 at 37′ was a small pocket about 2′ in diameter and 24″ deep. A bone awl and a pitching tool of antler were found below the surface at 18″.

Pit 19 on the west side of trench 1 at 48′ was a small pocket 2½′ in diameter and 48″ deep. The pit soil was black from the charcoal and ashes. Awl F242 was found in this pit.

Pit 20 at 46′ on the east side of trench 1 was an ash pit 3′ by 4′ in circumference and 30″ deep. The pit filling was uniform in character being an ash and charcoal mixed sand. Besides the usual quantity of animal bones, fire-broken stones and flint chips was found a hammer stone and the shell of Unio complanatus.

Pit 21 at 49′ on the east side of the trench was 7′ by 10′ in dimensions and 16″ deep. It seemed distinctly a refuse pit or lodge dump. It contained fire-broken stones, cracked and split deer, bear, beaver, rabbit, muskrat and skunk bones, also the bones of fish, charred corn and hickory nuts and one Unio shell. The following named implements were found intermixed amongst the pit refuse: 1 antler hoe or digging tool, F292 [pl. 35, fig. 1], 3 bone awls, F307, 308, 5 bone beads, F248 to 252 inclusive, 4 bone beads, F303 to 306 inclusive, 1 notched pendant, F301, 1 broken implement of deer's jaw, 1 broken bone needle, F302, 1 flint blade, F309, 1 discoidal shell bead, F300, 1 net sinker and 10 periwinkle shells.

Pit 26 in trench 1 at 77′ on the west side was a small pit 36″ deep. The pit refuse consisted of potsherds, charcoal and ashes. One pipe stem of clay and an entire stone pipe bowl, F246, were found in this pit. The pipe was in the ash layer 11″ below the surface.

The space intervening between pits 19 and 21 was hard and rather less disturbed than the surrounding earth, especially in the space between five post holes, as shown on the pit diagram. This space seems to have been a wigwam site.

Pit 27 at 75′ on the east side of the trench was a small depression. It contained the usual fire pit refuse and within it were found a flint perforator, a broken bone awl, a "lap stone," a pitted slab of shale and numerous animal bones. There was a deposit of Helix shells.

For 20′ beyond pits 26 and 27 the soil was barren of pits. The

Plate 4

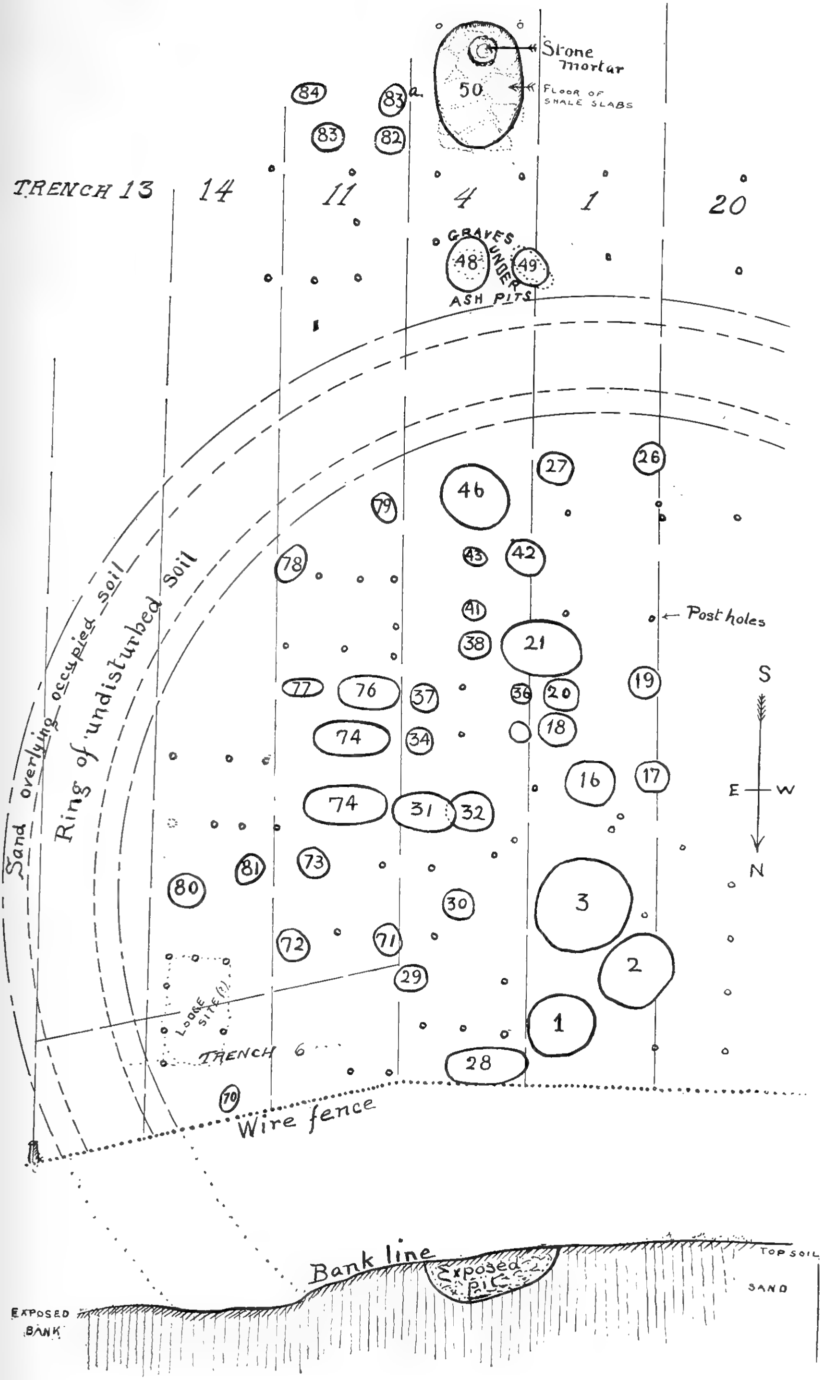


Diagram of the pits examined in the village section

trench soil at 40′ from the beginning was hard and compact with no occupied soil appearing.

Pit 28, discovered at the commencement of trench 4 on the west side was 18 feet from the lake bank. It was a trenchlike pit 10′ 4″ long east and west, 4′ wide and 52″ deep. It was filled with animal bones, deer and beaver, and other refuse. In the pit were found 4 bone awls, F274 to 277 inclusive, 5 bone beads, F278 to 282 inclusive, 4 incised bones, F284 to 287 inclusive, 1 bone needle fragment and 1 Venus mercenaria shell.

Beyond the pit and ranging from pit 1 in trench 1 to the trench line on the east were three post holes in a line. The soil beyond these post holes appeared to have been a part of a lodge floor.

Pit 29 was discovered at 12′ on the east side of the trench and it ran over on the east into the adjoining trench. It was a small ash pit 3′ by 4′ in dimensions and 48″ deep. The objects found were 1 bone bead, F256, 1 bone shuttle or bodkin, F245 [pl. 34, fig. 21], and 1 bone needle fragment, F243.

Pit 30 was a small shallow pit in which a quantity of elk bones had been buried. It was found in the center of a "lodge floor."

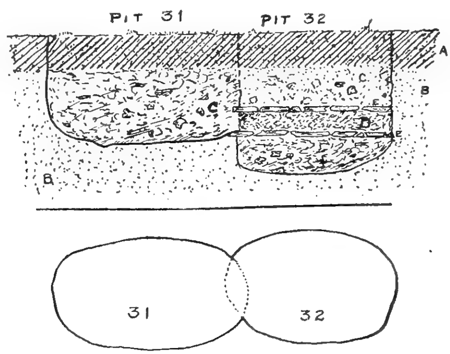


Fig. 2 Diagram of intruding pits 31 and 32. A = Top soil; B = Undisturbed sand; C = Disturbed sand and loam; D = Interlying stratum of sand between EE; EE = Floors of shale slabs

Pit 31 at 43′ in trench 4 was 5′ by 8′ in top diameters and 28″ deep. It contained a quantity of animal bones and potsherds. In this pit were found awl F268, bone bead F247 and terra cotta pipe bowl, F244 [text fig. 24].

Beyond this pit was a "lodge floor" and several post holes.

Pit 32 at 42′ on the west side of trench 4 intruded pit 31 [text fig. 2]. It was 5′ by 6′ in top dimensions and 72″ deep. The pit was in three strata separated by layers of flat stones. The middle

and bottom strata were heavy deposits of ash and charcoal in which were numerous animal bones, pot fragments and flint chips and fire-broken stones.

The objects found in the layer directly beneath the top soil and overlying the first floor of stone slabs are: 1 small celt, F200, 1 rude celt, F201, 7 bone awls, F202 to 208 inclusive, 7 triangular flint projectile points, F209 to 211, F211a to 214 inclusive, a quantity of charred corn, F140, 1 short rectangular iron bar, F226 and an iron-stained pebble found in contact with the bar, F241. In the bottom layer were found, 1 bone bead in process, F215, 5 bone beads, F216 to 220 inclusive, 1 triangular flint point, F221, 2 pot rim points F222, 223, 1 fabric-marked sherd, F224, 1 bone plug, F225. An animal bone evidently gnawed when fresh, F363, was also found in the bottom layer.

Pit 34 was a solid ash pit 4′ 4″ by 5′ in top dimensions and 48″ deep. It contained a quantity of animal bones among which those of deer, rabbits, beavers, heron and sturgeon were identified.

The artifacts found are: 1 hollow handlelike bone, F227 [pl. 33, fig. 5], 1 antler chisel, F228 [pl. 35, fig. 2], 1 fragment of perforated turtle shell, F229 [pl. 32, fig. 11], 1 conical worked phalanx, F330 [pl. 32, fig. 4], 1 deer bone rubbed and shaped, 1 awl, F231, 4 triangular points of flint, F232 to 235 inclusive, 2 pot rim points, F237, 238, 1 bear tooth, F240.

Pit 35 was a small pocket at 45′ on the west side of trench 4. It contained a few animal bones, an antler stub, 1 bone tube, F311, 1 bone needle fragment, F312, 2 bone awls, F313, 314, and 1 flint knife.

Pit 36 in trench 4 at 50′ on the west side adjoined pit 20 in trench 1. It was 34″ in diameter and 36″ deep. It was filled with the ordinary pit soil in which were found cracked deer bones and a few potsherds.

Pit 37 in trench 4 on the east side was directly south of pit 34 and on its east side adjoined another pit that ran into the next trench (afterward found to be pit 76). This pit was circular at the top, 3′ 8″ in diameter and 30″ deep. In the pit filling were a few split deer bones and the fragments of several broken pottery vessels.

Pit 38 in trench 4 at 55′ in the middle of the trench was a small ash pit 3′ by 4′ in top dimensions and 32″ deep. The articles found in this pit are: 1 section of an incised antler, F172, 1 worked bone, F194, 1 bone awl point, F198.

Pit 41 in trench 4 was directly north of 38 and was separated

from it by a space of 3′. This pit was 28″ by 34″ in top dimensions and 28″ deep. The bottom was filled up to 18″ from the top with shale slabs. Resting within the pit filling upon the fragments of shale were 2 "lapstones," several "rubbing stones" and a quantity of broken pottery. There were 2 bone beads, F320, 324.

Pit 42 in trench 4 at 65′ on the west side was a small ash pit 4′ by 5′ in diameter and 24″ deep. It contained the following named objects: 1 phalanx cone, F196 [pl. 34, fig. 8], 1 bone awl, F323, 1 large bone awl, F325, 1 pot rim point, F329, and three deer phalanges, F317, 318, 319.

Pit 43 in trench 4 at 65′ in the middle of the trench was a small pit 2′ by 3′ in top dimensions and 30″ deep. It contained a quantity of bones and the fragments of a broken pot.

Pit 46 in trench 4 in the middle at 75′ was 8′ by 9′ in top dimensions and 26″ deep.

Buried with the animal bones, broken stones and potsherds with which the pit was filled were the following objects: 1 perforated Unio complanatus shell, F321 [pl. 36, fig. 5], 4 deer phalanges, F317, 318, 319, 332, 1 bone bead, F326, 2 sheep-head perch ear bones and the fragments of a large pottery vessel.

Pit 48 at 99′ in the middle of trench 4 was an ash pit containing the usual refuse material of animal bones and fire-cracked stones. In the bottom of this pit was a skeleton. This pit is further described in grave XXIII, pit 48.

Pit 49 at 100′ on the west side of trench 4 was an ash pit 4′ by 5′ in top dimensions and 42″ deep. It was filled with quantities of ashes, charcoal and fire-burned stone. In the bottom of the pit was the skeleton described in grave XXIV, pit 49.

Pit 50 in trench 4 at 121′ covered almost the entire width of the trench, being 11′ wide and 15′ or 16′ long. Between this pit and pits 48 and 49 just previously described were a number of post holes and indications of a lodge floor. Pit 50 was in two strata divided by a layer of flat stones. The top stratum which was crammed with animal bones, split and cracked, potsherds, flint chips, and fragments of heat-cracked stones, was 24″ deep. Upon the slabs of shale at one end was a large stone mortar, F358. Other objects found were 2 bone awls, F357, 1 pitching tool, F359, 1 hammer stone, F361, 3 bone beads, F352, 353, 354, 1 triangular arrow point, F356, 1 polished raccoon penis bone, F355c [pl. 34, fig. 18], 1 flint scraper, F351, 2 bone awls, F349, 350, 1 grooved bone implement, F348 [pl. 34, fig. 13].

Stratum 2 beneath the stone floor was 22″ deep. It contained more ashes and less animal bones than the first. The following articles are from this deposit: 1 smoothed bone, F347, 3 pot rim points, F344, 345, 346, 1 triangular flint point, F343, 1 antler implement, F342, 1 perforated wolf's tooth, F341, 1 spatulate bone, small, F362 [pl. 34, fig. 12].

Pit 53 in trench 3 [*see* burial section map] was the first ash pit found in this trench and the first beyond the border of the burial ground. It was similar to other ash pits and contained the split and cracked bones of deer, bear, muskrat, beaver, heron and various fish. The only worked article found was an antler cylinder.

Pit 55 in trench 7 was an ash pit on the eastern slope of the knoll. It was irregular in dimensions but approximately 6′ by 7′ and 30″ deep. It contained a quantity of elk bones, deer bones, including a skull top, and a few beaver bones. The artifacts are 1 perforated elk's tooth, F363 [pl. 34, fig. 2], 2 bone beads, F364, 365, 1 bone pitching tool, F367, 1 antler hoe, F368, and 1 yellow jasper arrow point.

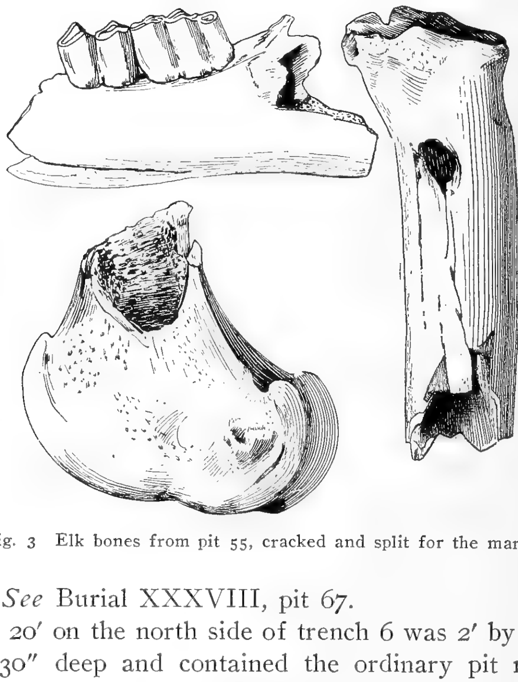


Fig. 3 Elk bones from pit 55, cracked and split for the marrow

Pit 66. *See* Burial XXXVIII, pit 67.

Pit 70 at 20′ on the north side of trench 6 was 2′ by 3′ in dimensions and 30″ deep and contained the ordinary pit refuse. The following named objects were found: 1 bone awl, F378, 1 awl point, F379, and 1 incised beaver tooth, F382.

Pit 71 on the west side of trench 11 at the beginning was 3½′ by 4′ and 43″ deep. It was filled with discolored sand with which were intermixed carbonized substances. A few cracked deer and bear bones were found and 1 bone awl, F381.

Pit 72 on the east side of trench 11 at 6′ was 3½′ by 4′ and 24″ deep. In it were found the bones of deer, bear, beaver, turkey, heron and various fish but no implements. The top soil above and around pit 72 was black and otherwise discolored. Between this pit and 73 the black soil was 20″ deep but contained no intrusive objects.

Pit 73 at 16½′ in trench 11 on the east side was 3′ 9″ by 3′ in top dimensions and 34″ deep. It contained a quantity of deer, rabbit and beaver bones, a Unio shell, a large broken pot and 1 bone awl. The ash deposit was not heavy.

Pit 74 at 20′ on the west side of trench 11 was 10½′ by 5½′ in top dimensions and 32″ deep. The pit refuse consisted of potsherds, various bird and fish bones, deer, bear and beaver bones, fire-broken stones, flint chips and charcoal intermixed with the sand and ashes that formed the major portion of the pit filling. The following objects were found: 3 bone awls, F394, 395, 380, 1 smoothed phalanx, F396, 1 pipe stem, F397, 1 large bone awl, F399, and 1 rude awl, F400.

Pit 75 at 30′ on the west side of trench 11 was an ash pit 10′ by 4′ 6″ in top dimensions and 30″ deep. It contained the bones of sturgeon and various other fish, bird bones, deer, beaver, and skunk bones and several Unio shells. The following articles of human manufacture were discovered: 1 smoothed deer phalanx, F388, 1 bird bone awl, F389, 1 flat deer bone awl, F390, 3 rude bone awls, F391, 392, 393.

Pit 76 at 35′ on the west side of trench 11 was 8′ by 4′ 2″ in top dimensions and 20″ deep. It was in two layers separated by a dividing layer of sand. The first layer was a foot deep and the second 7 inches. The dividing layer was an inch in thickness. The objects found were: 1 worked deer phalanx, F385, 2 polished bone beads, F386, 387, 1 elk molar, 2 Unio shells, 1 beaver tooth and 1 cut bone.

Pit 77 at 39′ on the east side of trench 11 was a two-strata pit with a top diameter of 2½′ and a depth of 30″. The topmost layer was 18″ in thickness and rested upon a dividing layer of sand beneath which was a deposit of ashes about a foot in depth. The top layer contained a large number of deer bones. In this layer

was found 1 flattened ball of antler [pl. 35, fig. 6] and a small edged pebble, F401.

Pit 78 at 55′ on the east side of trench 11 was 3′ by 5′ in top dimensions and 30″ deep. It contained a large number of cracked deer bones and scattered through the refuse were the following named articles: 1 serrated deer rib, F402 [text fig. 21], 1 worked bone, F403, 1 scratched and gnawed deer's femur, F404, 1 chisel-edged pebble, F405, 1 celtlike tool made from a pebble, F406, 1 miniature celt made from a natural pebble, F407, 1 long tubular bead, F408, 1 triangular jasper arrow point, 1 flint bunt, F410, 1 pot rim fragment, F411, 1 long triangular flint point, F412, 2 rude bone beads, F413, 414, 1 section of a charred wooden pipe stem, F415.

Pit 79 at 60′ on the west side of trench 11 was 3′ 8″ by 3′ in top dimensions and 32″ deep. It contained a large quantity of ashes, gray and white. 14″ from the top were found 1 antler point with hollowed socket, F424 [pl. 35, fig. 8], 1 double pitted stone, 1 bone awl, F425, 1 worked beaver tooth, F426 and 1 worked deer phalanx.

Pit 80 at 11′ in trench 14 on the east side was 4′ in diameter and 60″ deep. It was in two layers divided by a thin layer of top soil thrown in anciently. The uppermost layer was 48″ thick and the bottom one 12″. The former contained the bones of a number of animals among which the following were identified: deer, elk, moose, bear, wildcat, skunk, beaver, turtle, sturgeon. In the ashes at the top of the pit were found three perfect celts and a butt and an edge of two others. All were 17″ below the surface. The presence of these celts in this feast pit suggested the idea that here had been a council, a feast and a "burying of the hatchet ceremony." Other objects from the pit were potsherds, flint chips, charred corn and charred cobs, three sections of a broken bone needle, F416, 417, 418 several pot rim fragments and a terra cotta pipe bowl. The numbers of the celts are F450, 451, 452.

The ground at the beginning of this trench and nearly up to the pit contained post holes and seemed to have once been a "lodge floor."

Pit 81 at 13′ on the west side of trench 14 was 3′ by 4′ in top dimensions and 36″ deep. It contained a large quantity of ashes and charcoal. Near the top were a few deer bones, a polished bone bead, F420 and a charred corn cob, F419.

There were no pits beyond pits 80 and 81 but indications of lodge sites in two places. Pit 78 in trench 11 intruded the trench line at 50 feet on the west side but beyond it on the west there was a barren belt that cut the trench diagonally and intercepted the trench line on the east side at about 40′.

Plate 5

Diagram showing the position of the graves examined

Pit 82 in trench 11 at 110′ on the west side was 3′ 3″ by 3′ 6″ in top dimensions and 60″ deep. It contained few animal bones but a quantity of pot fragments. The noteworthy objects are 2 tubular bone beads, F434, 435 and a fragment of a black clay pipe bowl in the form of a bear's head, F423 [fig. 24a].

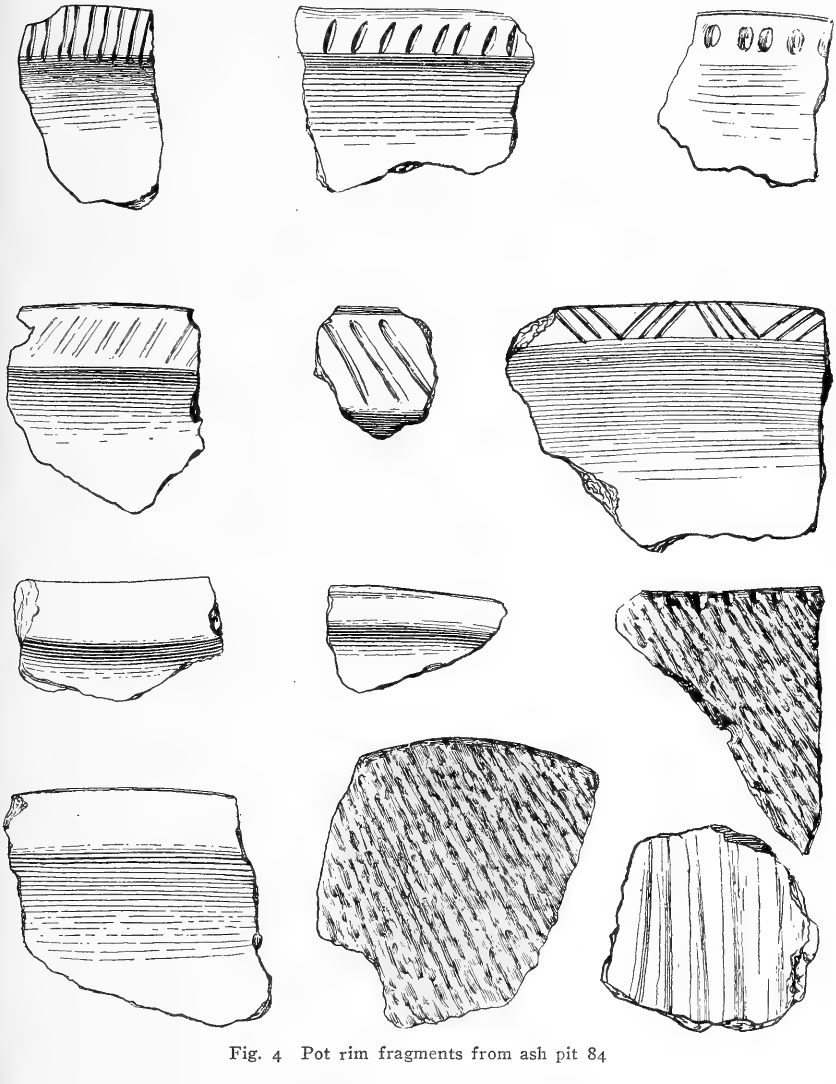


Fig. 4 Pot rim fragments from ash pit 84

Pit 83 at 110′ east central in trench 11 was just east of pit 82. It was 4′ 2″ by 3′ 3″ in top dimensions and 35″ deep. It contained a quantity of broken deer bones which had become intermixed with

the pit filling of ash charcoal and discolored sand. A triangular flint arrow head, F195, and a bone bead were found in this pit.

Pit 83a at 115′ on the west side of trench 11 was just beyond pit 82. It was 5½′ in top dimensions and 35″ deep. The specimens found are 2 deer jaws, inferior maxillae, 1 celt edge, F448, 1 hammer stone, F440, 1 grooved stone, F512, 1 drill, 1 broken pot, 1 pipe stem and 1 pitching tool.

Pit 84 at 115′ on the east central side of trench 11 was 2′ 8″ by 4′ in top dimensions and 42″ deep. It was an ash and refuse pit of the usual type and contained the following named objects: 3 bone awls, F436, 437, 438, 1 worked beaver tooth, F439, 2 Unio shells, 2 bone beads, 1 shell bead, 1 small crushed pot, 1 pipe bowl fragment and 1 arrow point. There were a quantity of deer bones in this pit and the rims and fragments of at least 10 different pots [*see* text fig. 4].

A trench parallel to trench 14 was run on the east side but 70′ of excavation failed to reveal any trace of pits. The occupied soil was light and in places there was hardly a trace of it.

Pit 148 was in the broad trench 7 on the east slope. It was probably a refuse pit, few ashes or charcoal being found within it. One specimen, a small bone pestlelike object, was found.

Pit 149 at 10′ in trench 7 was a refuse deposit of animal bones.

Pit 150 at 15′ in trench 7 was an ash pit. In the deposit of refuse were found, 1 bone awl, 1 celt butt, 2 arrow points.

Record of the graves

Grave I, pit 4, was discovered at the commencement of trench 3. When the top soil had been removed an area of disturbed earth 48″ by 56″ was found. The undisturbed sand surrounding the grave top was a rather compact gritty sand intermixed with small pebbles. Several small particles of charcoal in the disturbed earth evidenced a disturbance by human hands. At 38″ from the top a crumbling skull was uncovered by the trowel. The superincumbent earth was removed and the remains of the skeleton exposed and photographed. The skeleton was in an advanced state of decay and it was impossible to determine the sex or measure any of the bones. A perfect pottery vessel, undecorated and of the old square-topped Iroquois form was found 15″ northeast of the face. It was upright and filled solid with sand [*see* text fig. 5, *also* pl. 27]. Orientation of the skeleton: head south, face east, right side, flexed position (apparently).

Plate 6

Pit 4, trench 3. Looking directly down into the grave. The bones had almost entirely crumbled, a part of the skull and a portion of the femur only remaining. With the skeleton was a pottery vessel

The details of grave I are shown in plate 6.

Grave II, pit 5, trench 3 at 6′ on the west side. This grave was 56″ deep. The bottom contained hardly a trace of the black clay-like soil usually found in grave bottoms. The bones had entirely

Fig. 5 Square-topped pot from grave I

crumbled and only streaks of white powder remained by which a seemingly flexed position might be traced.

Grave III, pit 6, in trench 3 at 8′ on the east side contained the crumbling remains of a skeleton 42″ below the surface. Orientation: head north, face west, right side, flexed position.

Grave IV, pit 7, in trench 3 at 12′ on the west side contained the skeleton of an adult female, 42″ below the surface of the ground. The top dimensions of the grave were 36″ by 70″. The bones were crushed and broken by the weight of the earth. The vertebrae were nearly complete. Orientation: head south, face east, right side, flexed position.

Grave V, pit 8, in trench 3 was a grave 38″ deep and 36″ by 72″ in dimensions. The bones were in a poor state of preservation. The grave soil was black and discolored. Orientation: head north, face west, right side, flexed position.

Grave VI, pit 9, in trench 3 at 15′ on the west side was 42″ by 60″ in top dimensions. At 26″ down a broken skull was found. The earth was carefully removed and the skeleton and grave bottom brushed off. On the grave bottom just above the skull was found a massive terra cotta pipe bowl filled with charred tobacco [*see* text fig. 6 and pl. 31, fig. 1]. The bowl, which was decorated with deeply incised lines, had a short neck and a short nipple over which

a stem might be fitted. The skeleton was in a crumbling condition and almost useless for scientific purposes. It was evidently a male. Orientation: head southeast, face northeast, right side, flexed position with the skull bowed down upon the sternum. A photograph of the grave is shown in plate 7.

Grave VII, pit 10, in trench 3 was at 18′ on the west side of the trench. It contained the crushed skull of an adult male and a number of fragments of calcined bone. The skull was upright with the lower jaw under and was in an advanced stage of dis-

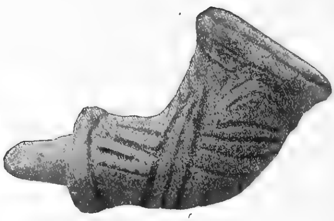


Fig. 6 Massive pipe bowl from pit 9, grave VI

integration. It was the only part of the osseous matter not calcined. Near the skull was found an oval flint blade [pl. 23, fig. 2], a flint chip, and a small fragment of asphalt which had evidently been used for its coloring matter.

Grave VIII, pit 11, in trench 3 was at 18′ on the east upside of the trench was 36″ by 50″ in top dimensions and 60″ deep. At 55″ down the side of the skull was discovered and the grave bottom found 5″ below. This grave was traced down from the topsoil by the loose sand which other than its looseness showed no trace of disturbance. No bits of charcoal, lumps of clay or topsoil were intermixed with the sand. The grave bottom was streaked with ocher and the skeleton lay in a considerable deposit of it. There was a large lump of red ocher 3 inches from the base of the skull. The bones were those of an adult male and in a fair state of preservation. The skull is noticeably large and the bones large and long. At the back of the occiput, that is to the east, with the edge 3 inches from the skull, was a large polished celt. Just above the celt, that is to the north, was a crushed pottery vessel. Below the celt an inch from the second dorsal vertebra was a streak of decayed wood, possibly cedar, and perhaps the remains of the celt handle [*see* pl. 38, fig. 3]. The grave soil beneath the red pigment was a dead black and was phosphatelike in its composition. This black deposit was 3/16 of an inch in thickness. A charred bean and a dozen

Plate 7

Grave pit 9, trench 3. This grave contained the crumbling skeleton of an adult male. With the skeleton at the place indicated by the photograph was found a pipe of a most peculiar form [*see* pl. 31, fig. 1]

kernels of charred corn were found in the grave soil. Orientation: head north, face west, right side, flexed position. Sex, male of perhaps 30 years.

Grave IX, pit 12, in trench 3 at 35′ on the west side contained the decayed skeleton of a youth of 12 or 14 years. The grave bottom 37″ below the surface, rested on the clay stratum. Orientation: head south, face west, left side, flexed position.

Grave X, pit 13, in trench 3 in the middle of the trench at 35′ was just east of grave IX. On the eastern end of the grave another intruding grave was found and is described hereinafter. At 42″ from the surface in the clay stratum was found a badly decayed skeleton. Orientation: head south, face west, left side, flexed position.

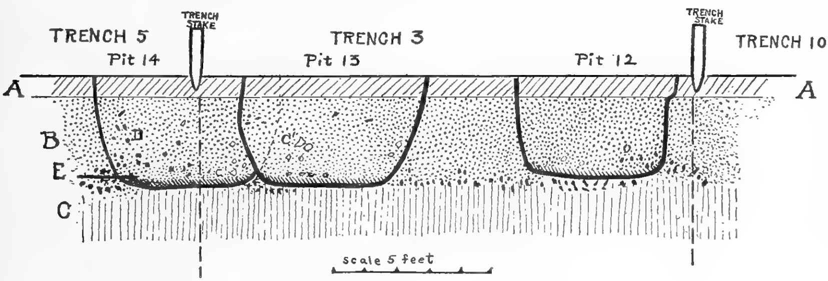


Fig. 7 Diagram of pits 12–14

Grave XI, pit 14, in trench 3 was 35′ on the east and outside of the trench. This pit and pit 13 previously described intruded one another. At 42″ from the surface the right femur of a young adult was uncovered by the trowel. The superincumbent earth was removed and the crumbling remains disclosed. The femur bones alone were in fit condition for removal, the others being too soft and crumbling for accurate measurement. The femora measured, right, 18.03″, left, 18″. A crushed pot was directly north of the skull and a deposit of purple pigment lay near the frontal bone. In this "war paint" was found a decayed bone tube. The grave bottom was lined with charred grass. Orientation: head north, face east, right side, flexed position with femora at right angles to the body.

Grave XII, pit 15, in trench 3 on the east side was just north of pit 14. At 40″ below the surface the remains of an adult male skeleton were found. The skeleton was badly decayed, some of the bones were calcined and the skull was crushed by the weight of the earth. The knees were drawn tightly up against the chin and the tibii were closed against the femora. A crushed pot was up-

right directly before the face and another at the pelvis. Orientation: head northeast, face northwest, right side, tightly flexed.

Grave XIII, pit 22, in trench 3 at 45′ proved to be the grave of a child of perhaps 6 years. The bones were fragile and broken and the skull was crushed by the weight of the earth. The grave bottom was 28″ below the surface. Before the face was a pottery vessel of Iroquoian form. The rim is missing from an ancient breakage and the pot body is cracked. Orientation: head south, face east, right side, flexed position.

Grave XIV, pit 23, in trench 3 was at 50′ on the west side of the trench. This pit was traced down by the disturbed sand in which were lumps of topsoil, charred wood and fire-cracked stone. A badly decayed skeleton of an adult female lay at 52″ below the surface in the clay stratum. To the rear of the skull was a pottery vessel having an ancient rim break. The three missing pieces were found in the grave soil and the vessel restored [*see* pl. 30, fig. 4]. An examination of the break suggested that it must have been caused by a stone or hard lump of earth when the grave was filled. Orientation: head south, face east, right side, flexed position.

Grave XV, pit 24, in trench 3 at 55′ was on the east side of the trench. It contained the crumbling skeleton of an adult lying 48″ below the surface. It was impossible to discover the position and there were no objects in the grave.

Grave XVI, pit 25, in trench 3 was just north of pit 24. At 42″ from the surface the grave bottom was found and in it a deposit of bone dust.

Grave XVII, pit 33, in trench 3 at 65′ on the east side of the trench was similar in character to grave XVI. At 48″ down there was a deposit of bone dust and a crushed pottery vessel.

Grave XVIII, pit 39, at 13′ on the east side of trench 5 contained the crumbling remains of a young adult male. A pottery vessel, F481 was found at the occiput an inch or two to the east. A small triangular flint arrow point was found in the lumbar vertebra and a fragment of a blue glass bead[1] at the pelvis. The grave was rectangular in outline being 35″ by 48″ and 36″ deep. Orientation of the skeleton: head northwest, face southwest, right side, position flexed.

Grave XIX, pit 40 at 17′ on the west side of trench 5 was rectangular in outline, being 3′ by 4′ and 49″ deep. The skeleton was that of an adult and so badly decayed that the teeth crumbled at

[1] This was the only object of glass found in any part of the site.

Plate 8

Fig. 1 Grave XX, pit 44

Fig. 2 **Grave XXV**, pit 51

touch. Orientation: head east, face north, right side, flexed. A large crushed clay vessel lay directly before the face.

Grave XX, pit 44, was discovered on the east side of trench 5 at 33′. The grave was irregular in outline and measured 66″ by 72″. The skeleton, found 49″ below the surface was that of an adult male of mature years. Orientation: head south, face west, left side, flexed position. The bones were crumbling and the head was crushed flat by the weight of the soil. Above the head with the bowl near the occiput was a terra cotta pipe [text fig. 8, *also* pl. 31,

Fig. 8 Terra cotta pipe from grave XX, pit 44

fig. 3, 4] the stem of which reached over the skull as shown in the photograph [*see* pl. 8, fig. 1]. Resting upon the head was the skull of a young bear, probably the remains of a bearskin robe. The bottom of the grave was lined with a layer of charred wood and bark ½ inch in thickness.

Grave XXI, pit 45, was at 38′ on the west side of trench 5. The removal of the topsoil disclosed a small fire pit, possibly the remains of a "grave fire." This pit was a foot in depth and contained white ashes and charcoal. Six inches below the topsoil was found a stone pipe bowl, egg-shaped, with a groove cut around it and intersecting the stem hole [*see* pl. 22, fig. 3]. The grave bottom was 46″ below the surface. After the skeleton had been freed of the superincumbent soil and brushed it was found to be the crumbling remains of an adult female. Orientation: head south, face east, right side, flexed position. The bones had been broken by the weight of the earth and the skull was badly crushed. Half of a bone bead was found resting against the atlas and axis of the neck.

Grave XXII, pit 47, was at 44′ on the east side of trench 5. When the topsoil was removed the pit outline was discovered to be rather circular, being 54″ in diameter. The top of the pit was

filled with charcoal and ashes. Below the ash pit proper was a deposit of sand intermixed with bits of charcoal, calcined animal bones and lumps of intruding soil. At 48″ a layer of flat stones was discovered. These were removed and 6″ below, the top of a broken pot was uncovered. The surrounding earth was removed and the crumbling skeleton of a female disclosed. Orientation: head

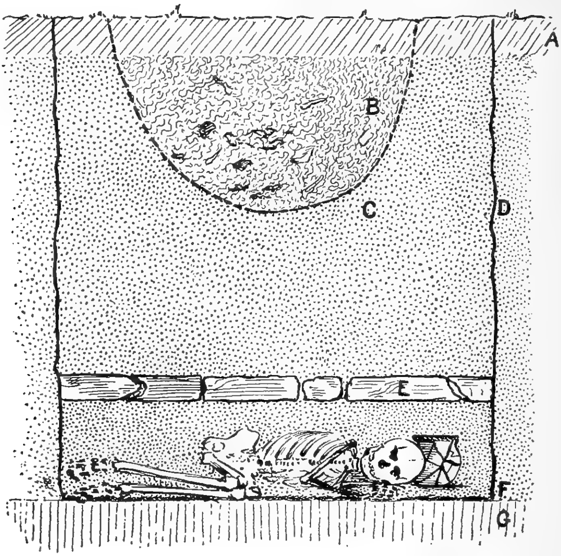


Fig. 9 Diagram of grave XXII. A = Top soil and disturbed layer; B = Fire pit; C = Disturbed sand overlying grave soil; D = Undisturbed sand; E = Overlying cover of shale slabs; F = Decayed organic matter; G = Clay

east, face south, left side, flexed position. The pottery vessel was at the occiput [*see* text fig. 9].

Grave XXIII, pit 48, was in trench 4 at 99′ in the middle of the trench. It was 5′ by 8′ in dimensions and 30″ deep. As the trench was one in the village section, that the pit was a grave was not suspected until a workman thrust his spade through the skull and the pottery vessel. The skeleton lay in a stratum of ashes, charcoal and sand discolored by decayed matter. Orientation: head east, face south, left side, flexed position. The broken pot which lay at the occiput was restored. The bones of the skeleton were well preserved by the ashes and seemed to yet contain a saponaceous substance, perhaps produced by the mixture of the lye from the ashes and the natural oleaginous matter in the tissue.

Grave XXIV, pit 49, was at 100′ on the west side of trench 4. An ash pit had intruded into the grave pit soil. At 42″ from the surface the grave bottom was discovered, upon it a thin deposit of bone dust.

Grave XXV, pit 51, was in trench 5 at 44′ on the west side. Dimensions 4′ by 6′ and 51″ deep. This pit contained the skeleton of an aged male which was in an advanced stage of disintegration. At the top of the skull and a little to the rear, southwest, was a clay pot having an ancient rim break. Near the inferior maxillary with the edge of the bowl nearest was a pottery pipe of the Huronian type [*see* pl. 31, fig. 2]. The position of the skeleton was, head south, face east, right side, flexed [*see* pl. 8, fig. 2].

Grave XXVI, pit 52, in trench 5 was at 48′ on the east side and lay directly beneath a tree. The grave bottom was 48″ below the surface and the skeleton had all but crumbled, probably owing to the fact that it lay in the clay stratum which had prevented drainage and thus promoted decay. Above the skull, that is to the north and east was a terra cotta vessel which broke in a dozen pieces when removed. The pottery is of poor temper and seems to have been insufficiently baked. Perhaps it had been hurriedly molded and quickly fired especially for interment with the body of the dead. The bones were long and slender and might have been judged to have been those of a woman had not an examination of the skull revealed well developed superciliary ridges over the orbits. Orientation: head east, face south, right side, flexed position.

Grave XXVII, pit 54, in trench 5 lay at 55′ on the west side. 55″ below the surface a deposit of bone dust was found in the clay stratum.

Grave XXVIII, pit 56, at 66′ on the west side of trench 5 was an empty grave. Several pits of this character have been noted but have not been recorded here. That they are graves seems apparent because the earth is disturbed and loose while the surrounding soil was compact. Either these excavations are the remains of very old burials or are the remains of burials from which the skeletons had been removed in accord with the old Huron-Iroquois custom that prescribed a removal of bones from graves at stated periods.

Grave XXIX, pit 57, was found at the beginning of trench 8. At 29″ from the surface was found a thin layer of bone dust. A crushed vessel lay back of where the skull had probably lain.

Grave XXX, pit 58, in trench 9 was at 3′ on the west side of the trench. This pit was rectangular in outline, being 42″ wide and

60″ long. The grave bottom was 24″ below the surface. The skeleton was in a poor condition and the bones were broken and decayed. The head lay to the east, the face north, right side, flexed position. In the grave were 2 pottery vessels, one to the west of the occiput and one almost under the skull, on one side with the mouth to the south.

Grave XXXI, pit 59, in trench 9 was at 9′ on the west side and was a small shallow burial pit. It was 10″ deep and contained besides a thin deposit of bone dust a small pottery vessel. The grave was probably that of an infant.

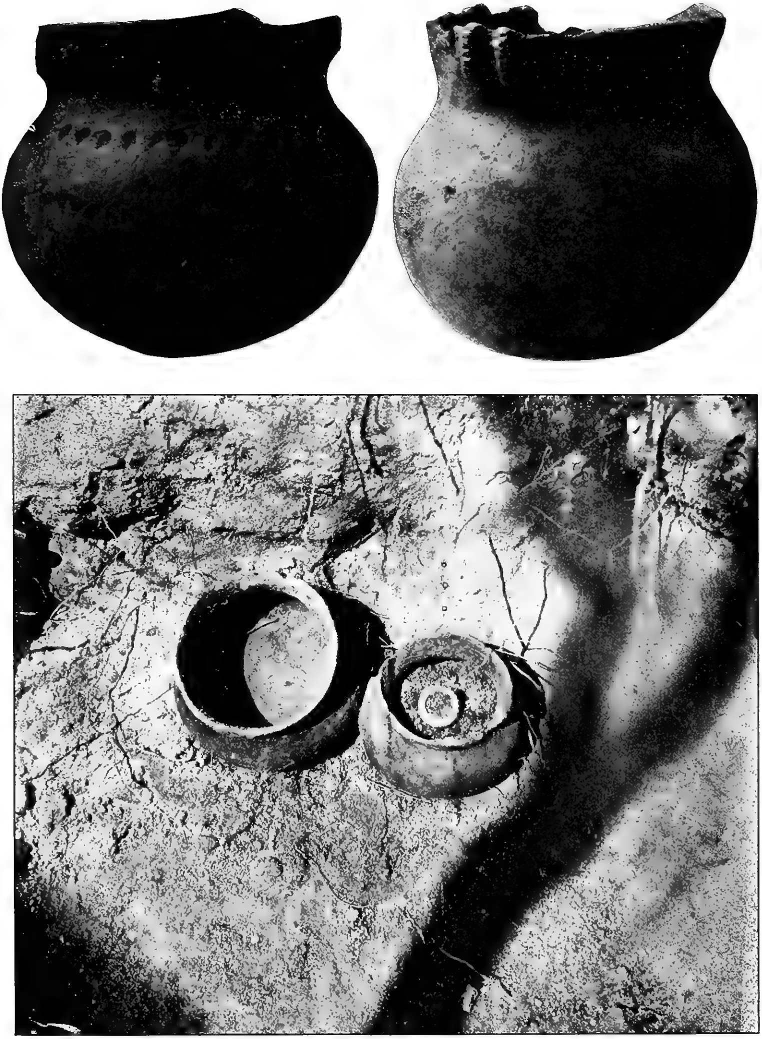
Grave XXXII, pit 60, was found 3′ south of 58, the southeastern corner of 58 touching the northwestern side of 59. This grave was 10″ deep and contained a plow-broken pot which may be restored. No trace of the skeleton was discovered.

It is probable that both 58 and 59 had originally been much deeper. The loose sand which forms the western hillside is easily shifted by storms of wind and rain and it is highly probable that much of the topsoil has been removed and shifted farther down the hill by these natural agencies. Those who have plowed this portion of the knoll have often ripped through pottery and bones and they may be seen even now in places white and crumbling upon the surface. It is probable that the real character of the bones was never guessed for they resemble the animal bones found on almost any cultivated ground as fertilizer.

Grave XXXIII, pit 61, in trench 9 was at 14′ on the west side. 30″ below the surface a disturbed skeleton was found and fragments of a broken pot. The burial seems to have been disturbed by some recent excavation.

Grave XXXIV, pit 62, in trench 10 on the west side was 33″ deep. In the grave bottom resting on the clay stratum were 2 terra cotta vessels. 4″ south of one of the vessels were 3 molar caps of a child of 10 or 12 years. Both of the pots were in good condition except for small rim breaks. The larger vessel was a typical Erie clay pot and the smaller one an unusual type. This latter one was half filled with some carbonized vegetable substance, very probably tobacco ashes. Buried in this ash was a clay pipe bowl of a modified trumpet form. When the pot was removed the ashes and the pipe were carefully packed as found. Above the grave was a fire pit 12″ deep. It contained a handful of charred corn and beans. This pit was probably dug for the grave fire and filled by its ashes [*see* pl. 9].

Plate 9



Pit 62 at 33′ in trench 10 contained the molar teeth of a child of 12 years. The excavation was probably a grave although no other osseous matter beyond the teeth was found. In the grave were two pottery vessels as shown in the photograph. One of the vessels is of an unusual form and contains a large quantity of charred tobacco ashes and the bowl of a terra cotta pipe. The pots are shown above the picture of the excavation

Grave XXXV, pit 63, in trench 9 was at 30′ on the east side. It was 40″ below the surface and contained the crumbling skeleton of an aged male. In the left foot between the metatarsal bones was a triangular arrowhead. The knees were drawn up within 11″ of the chin and in the intervening space were 10 flint and jasper arrow points, a piece of flint, a chisellike chunk of iron, an oval flint blade,

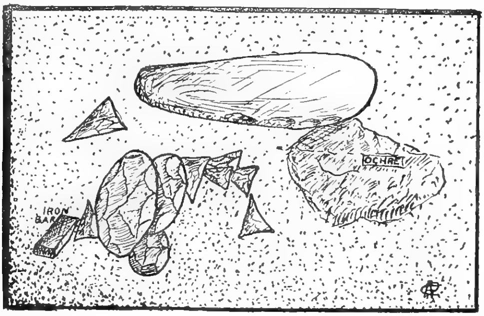


Fig. 10 Diagram showing position of articles in grave XXXV

a lump of red ocher and a smoothed pebble. The grave lay in the soft shifting sand of the hillside and most of the bones were crushed. Marks on the occiput seemed to indicate that the scalp had been cut, there being a deep circular incision in the bone. Orientation: head southeast, face northeast, right side, flexed position. Figure 10 shows the relative position of the objects as found in the grave.

Grave XXXVI, pit 64, trench 9, was at 33′ on the west side. This grave was 25″ deep and contained the crumbling skeleton of an adult and a broken pot of poorly tempered clay, probably hastily baked for the burial, and 5 triangular arrowheads. The skeleton lay with its skull to the east, face north, right side and flexed position.

Grave XXXVII, pit 65, was in trench 12 at the beginning on the west side and contained the skeleton of a female. The bones were in a poor condition and the skull was crushed on the upper left side. A little to the south-southwest before the orbits was a pottery vessel in perfect condition except for an ancient rim break. The soil in trench 12 was a loose gravel-mixed sand and to prevent this from sliding back into the excavation a large hole had to be dug. A careful examination of the grave top before the grave filling was removed gave the top dimensions as 48″ by 58″. The skeleton lay

with the head to the southwest, face northwest, right side, flexed position.

Grave XXXVIII, pit 67, was at 10′ on the east side of trench 12 and measured at the top 52″ by 72″. The soil was a light loose sand. Ash pit 66 was found directly over the grave. It was 48″ in diameter and 36″ deep and filled with fire-broken pebbles, split and cracked animal bones and carbonized wood intermixed with ashes and sand. Amongst this refuse were numerous potsherds, an elk tooth, 3 bone awls, imperfect, and 1 awl large and well made. There were also several lumps of clay. The pit is probably intrusive at a period later than that of the burial [*see* text fig. 11].

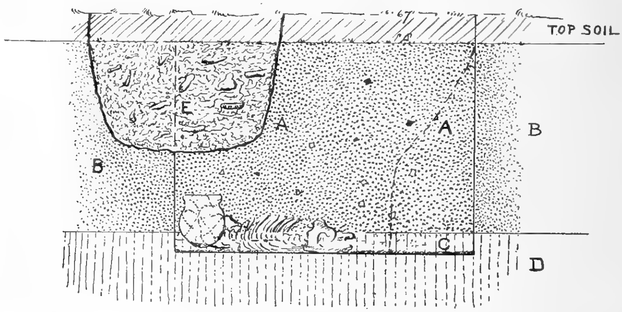


Fig. 11 Diagram of grave XXXVIII

The grave bottom was 16″ below the bottom of the ash pit. The skeleton was that of a female and was in fairly good condition, but the skull had been flattened and crushed by the weight of the earth. A crushed vessel lay at the back of the head. Orientation: head south-southeast, face north-northeast, right side, flexed position [*see* pl. 10].

Grave XXXIX, pit 68, at 15′ on the east side of trench 12 almost touched grave XXXVIII. It was somewhat smaller in dimensions, being 36″ by 48″ and 32″ deep. It held the remains of a child of 8 or 10 years. The bones were in a fair condition but there were no fibulae or tibii. The spine was noticeably curved and in other ways the skeleton seemed peculiar. Orientation: head east, face north, right side, flexed position.

Grave XL, pit 69, at 20′ on the west side of trench 12 was 42″ deep. It contained no trace of human remains. A pitcher-shaped pot was found on the east side of the excavation [*see* pl. 28, fig. 4].

Grave XLI, pit 86, at 55′ on the east side of trench 10 was 53″ deep. It contained the skeleton of an adult male the bones of which were badly crumbled. 10″ before the face of the skull

Plate 16

Grave XXXVIII, pit 67

was a small pottery vessel with one projecting and raised point, the whole pot being decorated with the marks of a cord-wrapped paddle [pl. 28, fig. 6]. Directly north of the top of the skull was a pottery pipe of the trumpet shape [pl. 31, fig. 5] and between the pot and the pipe were a celt, a chisel of shale, a worked beaver's incisor, a flint and steel and several worked bones much decayed. The grave bottom was in the clay stratum which accounts for the poor condition of the osseous matter. Orientation: head east, face north, right side, flexed position.

Grave XLII, pit 87, at 56′ in trench 10 on the west side was 34″ deep. No bones besides a few molar caps of an infant of 6 or 8 were found. A large pottery vessel, F444 [pl. 29, fig. 1], with an ancient rim break and showing signs of prolonged use was found in one end of the excavation near the teeth.

Grave XLIII, pit 88, was between pits 86 and 87, at 56′ in trench 10. In the grave bottom 48″ below the surface was found a deposit of fine bone dust resting on the clay. Pottery vessel F443 was found in this grave [pl. 28, fig. 5].

Grave XLIV, pit 89, was at 67′ in the middle of trench 10. On the grave bottom 38″ below the surface lay a disintegrating adult skeleton too soft and brittle for removal. There were no objects in the grave. Orientation: head south, face west, left side, flexed position.

Grave XLV, pit 90, at 65′ in trench 10 on the east side contained a crumbling adult skeleton resting in the clay stratum. The grave bottom was lined with charred bark and was 40″ below the surface. Orientation: head south, face west, left side, flexed position.

Grave XLVI, pit 91, in trench 15 was 48″ deep and contained the decayed skeleton of an adult. Before the face were two badly broken vessels made of poorly tempered pottery. The skeleton lay east and west with the top of the skull to the east, the face north, on its right side in a flexed position.

Grave XLVII, pit 92, at 84′ on the east side of trench 10 contained the decayed skeleton of an aged adult male. It lay with the head to the east, face south, left side and in a flexed position [*see* pl. 11]. The skull was badly broken but of some scientific value. The spinal column was completely ossified and was removed intact. Near the lower jaw was a small double edged celt [text fig. 12], above the skull, that is to the east, was a beautiful pottery vessel, typically Erian in form, with a small raised rim point [pl. 29, fig. 2, *also* text fig. 13], and before the abdomen with the stem hole

nearest was a pipe of most peculiar form, the shape of some animal [pl. 22, fig. 5, *also* text fig. 14]. One of the workmen, a Seneca

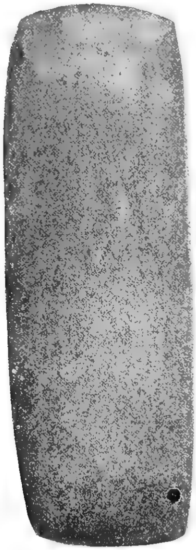


Fig. 12 Celt from grave XLVII, pit 92

Fig. 13 Vessel from grave XLVII, pit 92

Indian, pronounced it the representation of a mythical monster known to the Iroquois as the Niă gwă he. The grave bottom was 39″ by 63″ in dimensions.

Grave XLVIII, pit 93, was at 88′ on the west side of trench 10 and contained the remains of an infant skeleton. The bones were crushed and crumbling. No objects were found in the grave except a dry fibrous substance resembling the decayed fibers of some resinous wood. Orientation: head southwest, face southeast, right side, flexed.

Grave XLIX, pit 94, in trench 15 at 22′ on the east side contained the broken root-eaten skeletons of two adults. Before the orbits of the southmost skeleton were 5 triangular flint arrow points and at the chin a crushed pottery vessel. Near the orbits of the northmost skeleton was a black flint knife [*see* pl. 23, fig. 8]. Orientation: skeleton 1, head east, face north, right side, almost straight position; skeleton 2, head southeast, face northeast, right side, flexed position.

Grave L, pit 95, in trench 15 was at 22′ on the west side. It contained a deposit of bone dust and a crushed pot.

Plate 11

Grave pit 92, Ripley, at 84 feet in trench 10 was 3′ 4″ deep. It contained the decayed bones of an adult male of mature years. The spinal column was in one solid piece, the result of ankylosis. With the skeleton at the places indicated by the photograph were a double edged celt, a perfect pottery vessel, typically Erian, and a stone effigy pipe, representing some mythical animal [*see* pl. 22, fig. 5]

Grave LI, pit 96, at 102′ on the east side of trench 10 was a large grave [*see* pl. 12]. The topsoil was removed and the grave area found to be 72″ by 78″. At 36″ the rim of a pottery vessel was touched by the trowel, indicating the proximity of the grave bottom. The overlying soil was carefully removed with army trowels and the

Fig. 14 Effigy pipe from grave XLVII, pit 92

skeletons cleaned and brushed. The remains of 4 skeletons lay in the grave bottom, those of an aged female, 2 children aged about 10 and 12 years, respectively, and the skull-less remains of what seemed a male skeleton. The northmost skeleton was that of a child of about 12 years. Above its crushed skull was a badly broken pottery vessel. The second skeleton was that of a female and was likewise in a poor state of preservation. Above the fore-

Fig. 15 Small cup from grave LI, pit 96

head, to the east, was a large broken pot, back of the skull was a cuplike vessel [text fig. 15] with two smaller cups turned with mouths down over it. Near the dorsal vertebra between this skele-

ton and that of the child was a copper bead within which was a section of a deerskin thong [pl. 37, fig. 3]. Upon the right lower arm were 2 copper bracelets [*see* pl. 37, fig. 1, 2]. The copper salts which had been released by natural agencies from the metal, penetrating the substances beneath them had preserved portions of flesh, bone, skin, deerskin, and a portion of a bark sheet [*see* pl. 37]. The 4 fingers and thumb of the right hand were incased in wide rolled brass rings, the salts of which had preserved the animal tissues of the hand [*see* pl. 32, fig. 5, 10]. Beneath this hand was a deposit of red ocher. The third skeleton was that of a child and was badly decayed. Above the remains of the skull was a large pottery vessel [*see* pl. 30, fig. 5]. A fourth skeleton lay at the south end of the grave. It was fragmentary and minus a skull. Near the pelvis of this skeleton and near the knee of the female were 8 triangular arrow points. Between the female and male skeletons and below the second infant was a polished bar celt. The photograph [pl. 12] gives the details of the grave. Three skeletons headed east and apparently faced the south. It was not possible to determine the position of the fourth owing to its condition.

Grave LII, pit 97, at 33′ on the west side of trench 12 was 42″ wide, 48″ long and 42″ deep. It contained the root-eaten skeleton of a female. The skull was noticeably dolichocephalic and narrow.

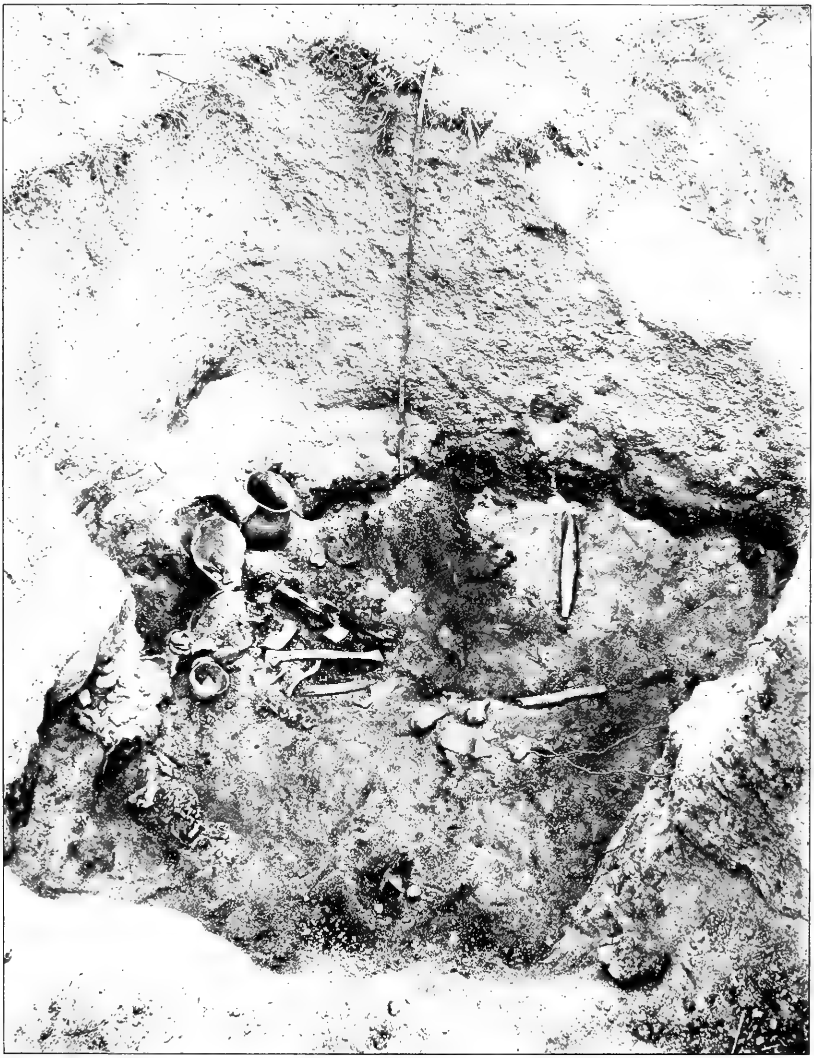
Grave LIII, pit 98, at 36′ on the west side of trench 12 was 52″ long, 48″ wide and 38″ deep. It contained the crumbling skeleton of an aged female. A crushed pot was found at the rear of the skull. Orientation: head south, face west, left side, flexed position.

Grave LIV, pit 99, at 33′ on the east side of trench 12 was 38″ deep. It contained a crumbling adult skeleton that lay with the skull to the west, face south, left side and flexed.

Grave LV, pit 100, in trench 16 on the east side at the beginning was 20″ deep and contained the crumbling remains of an adult male skeleton. The skull was mesocephalic. Before the face was a celt, F477 [pl. 20, fig. 12], formed from a piece of the local shale and to the south of the skull a few inches was a pottery vessel with a wide flaring rim, F478 [pl. 30, fig. 2]. The skeleton lay with the skull to the south, face west, left side and flexed.

Grave LVI, pit 101, was central in trench 16 at the beginning. At 30″ below the surface was found a root-eaten skeleton of a female. A crushed pot was found at the top of the head. The skeleton lay with the skull east, face north, right side and flexed.

Plate 12



Grave pit 96 in trench 10 contained the skeleton of an aged female, the lower right arm of which was almost entirely preserved by the copper salts formed from the heavy copper arm bands and finger rings. Two infants' skeletons were found at her side and the skeleton of a headless male, near which was found a bar celt. Ten pottery vessels were buried in this family grave. See descriptive matter in text

Grave LVII, pit 102, in trench 16 at 15′ on the west side lay on the trench line. The skeleton found 24″ below the surface was badly root-eaten and crumbled. The superciliary ridges over the orbits of the crushed skull indicated that the remains were those of a male. At the top of the skull were two typical Ripley-Erie pots. Orientation: head north, face east, left side, flexed.

Grave LVIII, pit 103, was a burial at 20′ in the middle of trench 16. At 22″ below the surface of the ground was found a crumbling root-eaten skeleton of an adult. At the occiput was a broken pot of unusual form and decoration. The skeleton lay with the head north, face west, right side and flexed.

Grave LIX, pit 104, was over the trench line of trench 16 at 24′. There was a light deposit of bone dust but no "grave dirt."

Grave LX, pit 105, west beyond LIX was outside of trench 16 in a projecting point of sand. A disintegrating skeleton was found 24″ below the surface. The bones were crumbled so that it was impossible to determine the position of them. A stone pipe of unusual form was found on the east side of the excavation. The

Fig. 16 Pot from grave LX, pit 105

pipe, F472, seems to be an attempt to represent a bear's claw [*see* pl. 22, fig. 4]. 7″ west of the pipe was a pottery vessel of an unusual form, F471 [text fig. 16]. Between the pot and the pipe lay a deposit of bone dust.

Grave LXI, pit 106, at 44′ on the east side of trench 15 was a grave with top dimensions of 66″ by 72″. At 56″ below the surface the grave bottom was found in the clay stratum. At the bottom was a black deposit of animal phosphate, black and clayey. There

was no visible trace of bone dust. In the southeast corner of the excavation pot F479 was found [*see* text fig. 17]. It had an ancient rim break but no sherds could be found in the grave soil.

Fig. 17 Pot from grave LXI, pit 106

Grave LXII, pit 107, at 33′ on the east side of trench 15 was 42″ deep. The skeleton was that of an adult male of mature years and was in a fair state of preservation. Even the *Os hyoid* remained. A superior maxillae of an adult bear was found over the skull, probably the remains of a bearskin shoulder robe. At the occiput and a little to the north was a beautifully shaped pottery vessel in an absolutely perfect condition, F474 [*see* pl. 26, fig. 1]. Two points of broken triangular arrows were found in the vertebrae of the neck just below the atlas and may have been the cause of death. The skull lay with the top to the southwest, face southeast, right side, flexed.

Grave LXIII, pit 109, at 50′ on the west side of trench 15 was 39″ by 50″ in dimensions and 38″ in depth. It contained the root-eaten crumbling skeleton of an adult. Orientation: head east, face south, left side, flexed.

Grave LXIV, pit 110, at 35′ on the east side of trench 15 was 42″ long, 40″ wide and 48″ deep. It contained a broken crumbling skeleton. A crushed pot lay at the top of the skull to the east. Orientation: skull east, face south, left side, flexed.

Grave LXV, pit 111, at 69′ on the east side of trench 15 was 42″ wide, 48″ long and 40″ deep. It held an adult skeleton. In the grave bottom was a layer of charred wood and bark 2″ thick. The skeleton lay with the skull pointing east, the face south, on its left side and in a flexed position.

Grave LXVI, pit 112, at 70′ in trench 15 on the west side was 52″ long, 40″ wide and 72″ deep. It held the skeleton of a female, the bones of which were poorly preserved. The skull lay to the east, the face north, and the skeleton lay on its right side, flexed as usual. South of the right scapula was a pottery vessel, F480. Over the grave was a small pit containing a quantity of ashes, charcoal, charred corn and a bear's tooth.

Grave LXVII, pit 113, at 55′ in trench 8 on the east side was 52″ long, 48″ wide and 63″ deep. The skeleton was in a fair state of preservation. It lay with the skull to the west, the face south, on its right side and in a flexed position. Before the face and 12″ from it was a fine specimen of Erie pottery, F476, and a lump of red ocher. The pot is figured in plate 26, figure 2.

Grave LXIX, pit 114, on the west side of trench 8 at 60′ was 60″ wide, 52″ long and 54″ deep. It contained the skeletons of an adult and child. Between the two skulls was a pottery vessel which rested in a deposit of red ocher. The skulls lay to the west, the faces south, each skeleton lay on the right side in a flexed position.

Grave LXX, pit 115, on the east side of trench 8 at 50′ was 54″ wide, 60″ long and 42″ deep and contained the skeletons of an adult and 2 infants. The bones were in a poor condition and were accompanied by no objects. The female skeleton seems, by the position of the skeletons, to have clasped both infants in her arms. Orientation: skulls northeast, faces southeast, left sides, flexed.

Grave LXXI, pit 116, in trench 8 at 66′ on the east side was 66″ long, 48″ wide and 60″ deep. The skeleton was that of a male and comparatively was in a fair condition but very brittle. The skull as it lay in the grave measured from the occiput to the glabella 203 millimeters. When removed the skull came apart at the sutures. Before the face were 5 triangular arrow points and there were 2 in the right hand. There was a deposit of objects near the sternum, parts of 2 bone implements, fragments of beaver teeth, flints and a few chips. A deposit of red ocher lay beneath the right cheek. Orientation: skull north, face west, right side, flexed position.

Grave LXXII, pit 117, on the east central of trench 8 was 58″ deep. The skeleton was that of an aged male and was in a tightly

flexed position with the knees drawn up close to the chin. The larger bones were in a fair condition but the smaller ones including the ribs had entirely decayed. At the occiput was a clay vessel with a small rim break. An inch from the skull to the northwest was a crumbling turtle carapace with 4 perforations [*see* pl. 34, fig. 11]. A flint and chunk of iron lay beneath the chin as if they had been clutched in one hand and a small celt was in the angle formed by the flexed right arm. Four triangular arrowheads lay at the top of the skull, a point was found in the vertebrae below the atlas and another between the tibia and fibula of the right leg. Field measurements of the skull gave the bizigomatic length 4 1/16″ and the structural hight 7 14/16″, the distance from the glabella to the aveolar border of the superior maxillary 3 9/32″, the nasal index was about 66.6 and the cephalic index 64.3. Orientation: head southeast, face southwest, left side, flexed.

Grave LXXIII, pit 118, on the west side of trench 15 at 82′ was 60″ wide, 72″ long and 48″ deep. It contained 2 skeletons one of which was badly decayed. The conditions seemed to indicate that the graves had been intruded and that the better preserved skeleton was more recent. The older skeleton lay with the skull toward the southwest, the face south-southeast and on the right side. The better preserved skeleton headed northeast, faced southeast and lay flexed on the left side.

Grave LXXIV, pit 119, in trench 17 on the east side at the beginning was 36″ in depth. It held the crumbling remains of a skeleton and a broken pot. This first or upper grave intruded another grave, the bottom of which was 3″ lower. Pot F511 was found in the lower grave. In both cases the vessels were back of the skulls. Owing to the condition of the bones it was impossible to determine the position of the skeletons.

Grave LXXV, pit 120, on the east side of trench 17 at 17′ was 42″ deep and contained the remains of a male. The grave soil from the top to 30″ down was heavily intermixed with carbonaceous matter and ash. At 30″ a layer of clay 6″ thick was struck and beneath it the skeleton. At a point midway between the lower jaw and knee was found a trumpet pipe of the flat flaring rimmed type, F536 [pl. 31, fig. 6]. It was imbedded in a cementlike composition of ashes, sand and gravel. The skull lay to the west, the face south and the skeleton lay flexed on the right side.

Grave LXXVI, pit 121, on the west side of trench 17 at 20′ was 42″ deep and contained the crumbling remains of a male skeleton.

Plate 13

Fig. 1 Grave LXXXI, pit 126. Two males in single grave
Fig. 2 Grave XCV, pit 135. Male and female in single grave

Before the sternum were 10 triangular flint arrow points, 1 perforator, 1 scraper, 2 flint flakes and 1 white spear or knife of white translucent chalcedony [*see* fig. 21].

Grave LXXVII, pit 122, at 25′ on the east side of trench 17 was a clearly defined grave but there was no visible vestige of human remains. The grave was 48″ deep.

Grave LXXVIII, pit 123, at 33′ on the west side of trench 17 was 48″ in depth and contained the exfoliating remains of 2 young females. At the occiput of skeleton 2 was a crushed pot. While examining the bottom of the grave another skeleton was discovered lying 6″ beneath. Around the cranium of the third skeleton were arranged 4 hammer stones in the form of a semicircle. The sex of this skeleton could not be determined owing to the condition of the bones. Skeletons 1 and 2 headed east, faced south and lay flexed on the left sides.

Grave LXXIX, pit 124, at 33′ on the east side of trench 17 was 3½′ distant from grave pit 123. It contained the skeleton of a male. It lay with the skull to the west, the face south, on the right side flexed.

Grave LXXX, pit 125, at 44′ on the west side of the trench was a small grave 24″ wide, 34″ long and 30″ deep. A fragment of an infant's pelvis and a crumbling vertebrae were all that remained of the skeleton. Beneath the bones was a quantity of charred wood and bark.

Grave LXXXI, pit 126, at 47′ in trench 17 on the east side of the trench contained the skeletons of 2 males of mature years [*see* pl. 13, fig. 1]. At the top of the skull of the southmost skeleton was a cord-marked vessel [*see* pl. 30, fig. 3], and at the occiput of the northmost was a broken vessel. Midway between the two was a round water-washed pebble stained with red ocher. At the abdomen of the northmost was a scapula and humerus and reaching beneath the right leg of the southmost was an ulna and a radius, the bones of an arm not belonging to either skeleton. In the lower leg of the southmost skeleton was an arrowhead of unusual material. The tip had been broken off but was found near the tibia. Orientation: southmost, skull northeast, face northwest, right side, flexed position; northmost, head southeast, face southwest, left side, tightly flexed.

Grave LXXXII, pit 127, at 55′ in the middle trench 17 was 42″ wide, 48″ long and 48″ deep. The crumbling skeleton was that of a male. At the top of the skull was a large pot cracked on one

side but otherwise in good shape.[1] When the skull was emptied two vertebrae and three phalanges fell from it. These had probably been placed in the skull by some small rodent, the remains of whose burrow were found circling the pot. An ash pit 20″ deep was over this grave. The skull pointed south and faced west and the skeleton lay on its left side, flexed.

Grave LXXXIII, pit 128, in trench 17 on the east side was found directly beneath a plum tree and therefore the skeleton could not be properly exposed. Within the grave at 49″ below the surface was found a female skeleton. At the occiput was a pottery vessel of the corded type. The skull pointed east, faced north, and the skeleton lay flexed upon its left side.

Grave LXXXIX, pit 129, at 67′ on the east side of trench 17 was 60″ by 62″ and 42″ deep. In this grave were 2 female skeletons. The eastmost skeleton lay upon its back with the face up and the inferior maxillary dropped upon the vertebrae. The westmost lay in the usual position. Orientation: eastmost, head southeast, face up, right side, flexed; westmost, head southeast, face northeast, right side, tightly flexed.

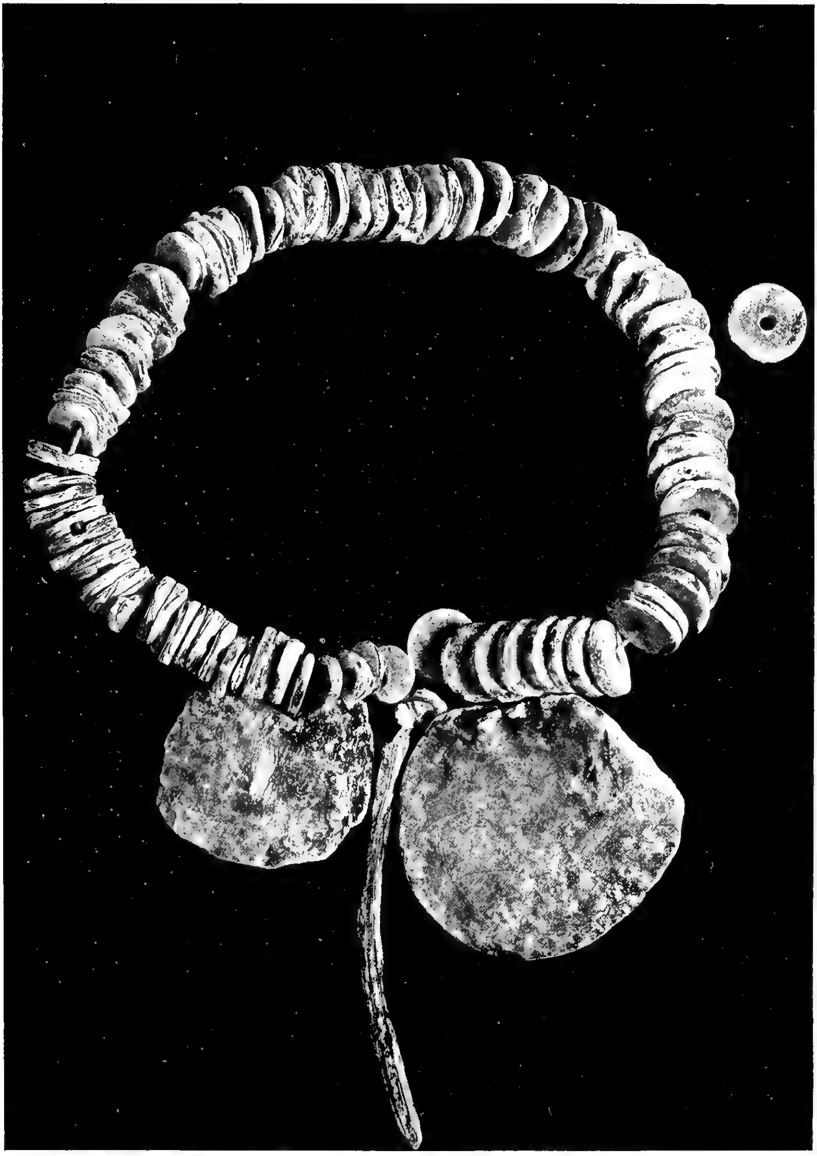
Grave XC, pit 130, at 67′ on the west side of trench 17 was separated from pit 123 by a space of 2′ 6″. The grave was 60″ long, 48″ wide and 52″ deep. Upon the bottom was a female skeleton crushed and flattened. On the middle finger of the right hand was a coiled brass ring. One of the same kind was found on the same finger of the left hand also. The right hand was held flat over the forehead and the copper salts from the ring had preserved a small patch of fine black hair and the scalp to which it was attached [*see* pl. 37, fig. 8], also a small piece of deerskin and a fragment of some bark fabric, both perhaps parts of the burial shroud. The skull pointed to the southeast, the face to the northeast and the skeleton lay on the right side, flexed.

Grave XCI, pit 131, at 66′ on the east side of trench 17 was 40″ deep and contained the skeleton of an adult female. A crushed pot containing the cracked bones of a deer was found at the occiput. Over the grave was a small shallow pocket filled with charcoal and ashes. This perhaps was a true burial or grave fire pit. The skeleton lay on the right side, flexed, with the skull east and the face north.

Grave XCII, pit 132, in trench 17 at 70′ on the west side was 47″ deep. In this grave was the skeleton of a female fairly well pre-

[1] This pot is the largest found in the site.

Plate 14



Necklace of shell disks found about the neck of a female skeleton, grave pit 133, trench 18, at 20′ on the west side. Restrung, bead for bead, as found

served. It lay upon its back with the face turned to the left but otherwise in the usual flexed position. At the top of the skull and a little to the front was a celt, F520. The skull lay to the southeast and the face southwest. Four views of the cranium are shown in plate 17.

Grave XCIII, pit 133, in trench 18 at 20′ on the west side was 39″ deep. Over the entire grave was a heavy layer of black carbonized substances, a foot in thickness. The fragile skeleton of a female lay in the grave bottom. Above and slightly to the rear of the skull was a crushed vessel. Before the face were flints, steel, F546, graphite, F545, red ocher and a heap of incised shell tablets, F617 [*see* pl. 36, fig. 1]. A necklace of discoidal shell beads, F618, encircled the neck [*see* pl. 14]. At the chin as if once attached to the circle of beads were 2 shell gorgets and a pendant, F516 [*see* pl. 36, fig. 2, 3, 7]. On the middle finger of the right hand was a coiled copper ring. The soil was an ash and clay mixed gravel and sand and cementlike. It was therefore very difficult to expose and remove the bones. The thin skull collapsed when lifted. The skeleton lay on its left side, flexed, with the skull pointing south and the face to the west.

Grave XCIV, pit 134, at 33′ on the east-central side of trench 18 was 42″ deep and contained the skeleton of a female. Owing to the cementlike character of the soil here and the fragility of the bones it was impossible to remove them. The skull which was crushed was taken up with great care but fell apart. A broken pot was found at the occiput. The skull headed south and the face was to the east. The skeleton lay on its right side, flexed.

Grave XCV, pit 135, at 22′ on the east side of trench 18 was 66″ wide, 66″ long and 42″ deep. Excavations revealed the skeletons of an adult male and female [*see* pl. 13, fig. 2]. Between the skulls was a crushed and broken pot. Near the shoulders of the female and touching the radius of the male were the following objects: 1 spatulate water-washed pebble, 4 flint chips, 4 leaf-shaped flint blades, 1 oval flint knife, 3 chunks of flint, 10 triangular arrow points and 1 scraper. The male lay with the head pointing toward the southeast and facing the southwest, on the left side and flexed; the female on its back with face up and skull to the south and legs flexed to the southwest.

Grave XCVI, pit 136, at 40′ on the east side of trench 18 was 48″ deep. Over the grave was a shallow ash pit in which was found a bear's tusk. The skull pointed toward the southeast, the face down and the body on the left side flexed.

Grave XCVII, pit 137, in trench 18 at 44′ on the east side was 37″ deep. It held the crumbling remains of a female's skeleton, headed east, facing south and on the right side flexed.

Grave XCVIII, pit 138, outside of trench 18 on the east at 44′ adjoining pit 137, was 48″ deep, 49″ long and 60″ wide. It contained the skeletons of a male and a female [*see* pl. 15, fig. 1]. The bones had been disturbed by some burrowing animal, probably a woodchuck. The skeletons lay back to back, the female on its left side and the male on its right. The skull of the female was twisted directly around and the lower jaw rested on the male's occiput with the chin toward its own skull. Between the two skeletons were three triangular arrow points, a leaf-shaped point and a lump of red ocher. The male lay with the skull to the south, the face east and flexed on the right side; the female originally probably lay facing the southwest with the skull pointing southeast, on the left side, flexed.

Grave XCIX, pit 139, at 66′ in trench 18 on the east side contained the crumbling remains of an adult. At the face were 9 triangular arrowheads and one oval flint knife. At the top of the skull was a broken pottery vessel and at the abdomen a deposit of red ocher. A broken triangular point was found in the decayed femur. At the foot of the grave, that is to the west, was the skull of a bear, a copper bead and a triangular flint. The skeleton lay with the head east, the face south, on the left side flexed apparently.

Grave C, pit 140, at 66′ in trench 18 on the west side was 42″ deep, 40″ wide and 50″ long. It held the crumbling remains of a male headed east, facing south on the left side. At the top of the skull and about 5″ from it was a pottery vessel, F515. At the occiput was a polished stone pipe and near the bowl 2 arrow points [*see* pl. 15, fig. 2].

Grave CI, pit 141, at 77′ on the east side of trench 18 was 36″ deep. In this grave was found the crumbling skeleton of a male. At the forehead was a broken pot and a black stone pipe rested on the ulna of the right arm. The pipe is figured in plate 22, figure 7. The skeleton lay on its right side heading east and facing south, on the right side, flexed.

Grave CII, pit 142, at 85′ on the west side of trench 18 was 32″ deep. It contained the crumbling remains of a child at the top of whose skull was a broken pot. The skull was toward the east, the face south and the skeleton lay on the left side flexed.

Plate 15

Fig. 1 Grave XCVIII, pit 138 Fig. 2 Grave C, pit 140

Grave CIII, pit 143, was at 5′ in the middle of trench 19 and was 32″ deep. It contained the crumbling remains of an adult female and an infant. The adult headed east, faced north and lay on the right side; the infant headed east, faced north and lay on the right side. At the occiput of the female was a deposit of red ocher.

Grave CIV, pit 144, at 22′ on the east side of trench 19 contained the skeleton of a male. Two arrowheads were found at the top of the skull. Orientation: skull east, face north, right side, flexed.

Grave CV, pit 145, at 100′ in the middle of trench 10, was 48″ deep. At one end of the excavation was a rimless vessel. The bones had disappeared.

Grave CVI, pit 146, on the east side of trench 19 at 66′ was 42″ in depth. The grave held the crumbling remains of an adult female headed northwest and facing southwest. Before the face was a crumbling pottery vessel.

Grave CVII, pit 147, on the west side of trench 19 at 70′ contained the crumbling skeletons of a female and an infant. At the occiput of the adult was a broken pot having an ear or handle.

Summary of the record of the graves

Burial	Pit	Depth in inches	ORIENTATION Face	Skull	Side	*c*Position	Sex	*b*Condition	Objects	Position
I	4	42	E	S	R	F		D	1 pot	15″ before face
II	5	56						E		
III	6	42	W	N	R			D		
IV	7	42	E	S	R		F			
V	8	38	W	N	R					
VI	9	30	NE	SE	R		M		1 pottery pipe	Above skull
VII	10	48				Bdl		Cal.	1 oval blade	Near skull
VIII	11	60	W	N	R	F	M		Pot, celt, paint	At occiput
IX	12	37					Juv			
X	13	42	W	S	L					
XI	14	42	E	N	L		M		Pot, bone, tube	Top of skull
XII	15	40	NW	NE	R			Cal.	2 pots	1 before face and 1 at pelvis
XIII	22	28	E	S	R		Juv		Pot	Before face
XIV	23	52	E	S	R				Pot	At occiput
XV	24	48								
XVI	25	42								
XVII	33	48						E	Pot	In bone dust
XVIII	39	36	SW	NW	R				Pot, arrow, glass bead fragment	Pot at occiput, arrow in spine
XIX	40	49	N	E	R				Pot	Before face
XX	44	49	W	S	L		M		Pipe	At top of skull
XXI	45	46	E	S	R		M			
*a*XXII	47	60	S	E	L		M		Pot	At occiput
*a*XXIII	48	30	S	E	L		F		Pot	At occiput
XXIV	49	42						E		
XXV	51	51	E	S	R	F	M	D	Pot, pipe	Top of skull below jaw
XXVI	52	48	S	E	L			E	Pot	At top of skull
XXVII	54	55						E		
XXVIII	56	60						E		
XXIX	57	29						E	Pot	At occiput (?)

XXX	58	24	N	E	R	...	...	D	2 pots	At occiput
XXXI	59	10	...	...	...	...	...	E	Pot	Indeterminate
XXXII	60	10′	...	...	...	...	...	...	Pot	Indeterminate
XXXIII	61	30	...	...	...	...	...	...	Pot fragments	Indeterminate
XXXIV	62	33	...	...	...	...	Juv	E	2 pots, 1 pipe	Indeterminate
XXXV	63	40	NE	SE	R	...	M	D	Flints etc	Before face
XXXVI	64	25	N	...	...	...	...	...	Pot, arrows	Indeterminate
XXXVII	65	48	NW	NE	R	...	M	D	Pot	Before face
XXXVIII	67	52	NNE	SSE	R	...	...	C	Pot	At occiput
XXXIX	68	32	N	E	R	...	Juv	D	...	...
XL	69	42	...	...	...	...	...	E	Pot	Indeterminate
XLI	86	53	N	E	R	...	M	D	Bone implements, pot, pipe, flints, celt	Pot before face, pipe over head (see records)
XLII	87	34	...	...	...	...	Juv	E	Pot	Indeterminate
XLIII	88	48	...	...	...	...	...	E	Pot	Indeterminate
XLIV	89	38	W	S	L	...	...	D	...	...
XLV	90	40	W	S	L	...	...	D	...	...
XLVI	91	48	N	E	R	...	...	D	2 pots	Before face
XLVII	92	40	S	E	L	F	M	D	Pot, celt, pipe	Pot above skull, pipe at abdomen, celt at jaw
XLVIII	93	30	SE	SW	R	...	Inf	D–E	Decayed wood	...
XLIX (*a*)	94	51	N	E	R	...	...	D	...	...
(*b*)	94	...	NE	SE	R	...	...	D	Flints	Before eyes
L	95	...	...	...	...	...	...	E	Pot	Indeterminate
LI (*a*)	96	42	S	E	L	...	F	D	...	Near skulls
(*b*)	96	42	S	E	L	...	Inf	...	9 pots etc.	(see records)
(*c*)	96	42	S	E	L	...	Inf	...	(see records)	...
(*d*)	96	42	...	...	R	...	M	...	Bar celt	At abdomen
LII	97	42	...	...	...	...	F	D–E	...	...
LIII	98	38	W	S	L	...	F	...	Pot	At occiput
LIV	99	38	S	W	R	...	...	D–E	...	...
LV	100	20	W	S	L	...	M	D–E	Pot, celt	Top of skull, face
LVI	101	30	N	E	R	...	F	D	Pot	Top of skull
LVII	102	24	E	N	L	...	M	D–E	2 pots	Top of skull

[a] Ash pit burials. [b] C=fair, D=poor, E=entirely disintegrated, Cal=calcined. [c] F=Flexed. Unless otherwise stated the position is flexed.

Summary of the record of the graves

Burial	Pit	Depth in inches	ORIENTATION Face	Skull	Side	cPosition	Sex	bCondition	Objects	Position
I	4	42	E	S	R	F	......	D	1 pot	15" before face
II	5	56	......	......	......	......	......	E	......	......
III	6	42	W	N	R	......	......	D	......	......
IV	7	42	E	S	R	......	F	......	......	......
V	8	38	W	N	R	......	......	......	......	......
VI	9	30	NE	SE	R	......	M	......	1 pottery pipe	Above skull
VII	10	48	......	......	......	Bdl	......	Cal.	1 oval blade	Near skull
VIII	11	60	W	N	R	F	M	......	Pot, celt, paint	At occiput
IX	12	37	......	......	......	......	Juv	......	......	......
X	13	42	W	S	L	......	......	......	......	......
XI	14	42	E	N	L	......	M	......	Pot, bone, tube	Top of skull
XII	15	40	NW	NE	R	......	......	Cal.	2 pots	1 before face and 1 at pelvis
XIII	22	28	E	S	R	......	Juv	......	Pot	Before face
XIV	23	52	E	S	R	......	......	......	Pot	At occiput
XV	24	48	......	......	......	......	......	......	......	......
XVI	25	42	......	......	......	......	......	......	......	......
XVII	33	48	......	......	......	......	......	E	Pot	In bone dust
XVIII	39	36	SW	NW	R	......	......	......	Pot, arrow, glass bead fragment	Pot at occiput, arrow in spine
XIX	40	49	N	E	R	......	......	......	Pot	Before face
XX	44	49	W	S	L	......	M	......	Pipe	At top of skull
XXI	45	46	E	S	R	......	M	......	......	......
aXXII	47	60	S	E	L	......	M	......	Pot	At occiput
aXXIII	48	30	S	E	L	......	F	......	Pot	At occiput
XXIV	49	42	......	......	......	......	......	E	......	......
XXV	51	51	E	S	R	F	M	D	Pot, pipe	Top of skull below jaw
XXVI	52	48	S	E	L	......	......	E	Pot	At top of skull
XXVII	54	55	......	......	......	......	......	E	......	......
XXVIII	56	60	......	......	......	......	......	E	......	......
XXIX	57	29	......	......	......	......	......	E	Pot	At occiput (?)
XXX	58	24	N	E	R	......	......	D	2 pots	At occiput
XXXI	59	10	......	......	......	......	......	E	Pot	Indeterminate
XXXII	60	10'	......	......	......	......	......	......	Pot	Indeterminate
XXXIII	61	30	......	......	......	......	......	......	Pot fragments	Indeterminate
XXXIV	62	33	......	......	......	......	Juv	E	2 pots, 1 pipe	Indeterminate
XXXV	63	40	NE	SE	R	......	M	D	Flints etc	Before face
XXXVI	64	25	N	......	......	......	......	......	Pot, arrows	Indeterminate
XXXVII	65	48	NW	NE	R	......	M	D	Pot	Before face
XXXVIII	67	52	NNE	SSE	R	......	......	C	Pot	At occiput
XXXIX	68	32	N	E	R	......	Juv	D	......	......
XL	69	42	......	......	......	......	......	E	Pot	Indeterminate
XLI	86	53	N	E	R	......	M	D	Bone implements, pot, pipe, flints, celt	Pot before face, pipe over head (see records)
XLII	87	34	......	......	......	......	Juv	E	Pot	Indeterminate
XLIII	88	48	......	......	......	......	......	E	Pot	Indeterminate
XLIV	89	38	W	S	L	......	......	D	......	......
XLV	90	40	W	S	L	......	......	D	......	......
XLVI	91	48	N	E	R	......	......	D	2 pots	Before face
XLVII	92	40	S	E	L	F	M	D	Pot, celt, pipe	Pot above skull, pipe at abdomen, celt at jaw
XLVIII	93	30	SE	SW	R	......	Inf	D–E	Decayed wood	......
XLIX (a)	94	51	N	E	R	......	......	D	......	......
(b)	94	......	NE	SE	R	......	......	D	Flints	Before eyes
L	95	......	......	......	......	......	......	E	Pot	Indeterminate
LI (a)	96	42	S	E	L	......	F	D	......	Near skulls
(b)	96	42	S	E	L	......	Inf		9 pots etc.	(see records)
(c)	96	42	S	E	L	......	Inf	......	(see records)	......
(d)	96	42	......	......	R	......	M	......	Bar celt	At abdomen
LII	97	42	......	......	......	......	F	D–E	......	......
LIII	98	38	W	S	L	......	F	......	Pot	At occiput
LIV	99	38	S	W	R	......	......	D–E	......	......
LV	100	20	W	S	L	......	M	D–E	Pot, celt	Top of skull, face
LVI	101	30	N	E	R	......	F	D	Pot	Top of skull
LVII	102	24	E	N	L	......	M	D–E	2 pots	Top of skull

a Ash pit burials. b C=fair, D=poor, E=entirely disintegrated, Cal=calcined. c F=Flexed. Unless otherwise stated the position is flexed.

Summary of the record of the graves (*concluded*)

Burial	Pit	Depth in inches	ORIENTATION Face	Skull	Side	*c*Position	Sex	*b*Condition	Objects	Position
LVIII	103	22	W	N	R	......	......	D	Pot	At occiput
LIX	104	24	......	......	......	......	......	E	......	......
LX	105	24	......	......	......	......	......	E	Pipe, pot	Indeterminate
LXI	106	56	......	......	......	......	......	E	Pot	Indeterminate
LXII	107	42	SE	SW	R	......	M	C	Pot, flints, bear's skull	At occiput
LXIII	109	38	S	E	L	......	......	D	......	......
LXIV	110	38	S	E	L	......	......	D	Pot	Top of skull
LXV	111	40	S	E	L	......	......	C	......	......
LXVI	112	72	N	E	R	......	F	D	Pot	At occiput
LXVII	113	63	S	W	R	......	......	C	Pot, ocher	Before face
LXIX (*a*)	114	54	N	E	R	......	Ad(F?)	D		
(*b*)	114	54	N	E	R	......	Inf	D	{ Pot	Between skulls
LXX (*a*)	115	42	SE	NE	L	......	F	D	......	......
(*b*)	115	42	SE	NE	L	......	Inf	......	......	......
(*c*)	115	42	SE	NE	L	......	"	......	......	......
LXXI	116	60	W	N	R	......	M	D	......	......
LXXII	117	58	SW	SE	L	......	M	C	Pot, flints, steel etc	Occiput etc. (see records)
LXXIII (*a*)	118	48	SE	SW	R	......	......	......	......	......
(*b*)	118	48	NE	SE	R	......	......	......	......	......
LXXIV (*a*)	119	36	S	W	R	......	......	D	Pot	At occiput
(*b*)	119	39	......	......	......	......	......	D–E	Pot	At occiput
LXXV	120	42	S	W	R	......	M	D	Pipe	Near sternum
LXXVI	121	42	......	......	......	......	M	D	Flints	Near sternum
LXXVII	122	48	......	......	......	......	......	......	......	......
LXXVIII (*a*)	123	48	S	E	L	......	F	D	......	......
(*b*)	123	48	S	E	L	......	F	D	Pot	Occiput
(*c*)	123	54	......	......	......	......	Ad	......	4 round pebbles	Around skull
LXXIX	124	42	S	W	R	......	M	D	......	......
LXXX	125	30	......	......	......	......	......	E	Charred bark	......

LXXXI (a)	126	48	SW	SE	L		M		Pot	At occiput
(b)	126	48	NW	NE	R		M		Pot	At top of head
LXXXII	127	48	W	S	L		M	D	Pot	At top of skull
LXXXIII	128	49	N	E	L		F	D	Pot	At occiput
LXXXIX (a)	129	42	up	SE	R		F	D		
(b)	129	42	NE	SE	R			D		
XC	130	52	NE	SE	R		F	D	Copper rings	On fingers
XCI	131	40	N	E	R		F		Pot	At occiput
XCII	132	47	SW	SE	back		F	D	Celt	Top of skull
XCIII	133	39	W	S	L		F	D	Pot, flints, shell beads, etc.	Occiput, face, neck etc. (see records)
XCIV	134	42	E	S	R		F	D		
XCV (a)	135	42	SW	SE	L		M		Pot, flints	Between skulls
(b)	135		up	S	back		F	C		at female's scapula
XCVII	136	48	down	SE	L					
XCVII	137	37	S	E	R		F	D–E		
XCVIII (a)	138	48	NE	SE	R		M			
(b)	138	48	NE	SE	R		F		Flints	Between skeletons
XCIX	139	42	S	E	L				Pot, flints, ocher, copper bead	Top of skull, face, abdomen, feet
C	140	42	S	E	L		M		Pot	At top of skull
CI	141	36	S	E	R		M		Pot, pipe	At face, on arm
CII	142	32	S	E	L		inf	D–E	Pot	Top of skull
CIII	143	32	N	E	R				Red ocher	At occiput
			N	E	R		inf	D–E		
CIV	144	40	N	E	R		M		Flints	Top of skull
CV	145	48						E	Pot	Indeterminate
CVI	146	42	SW	NW	R		F	D	Pot	Before face
CVII (a)	147	45					F	D–E	Pot	At occiput
(b)	147	45					inf			

a Ash pit burials. *b* C=fair, D=poor, E=entirely disintegrated, Cal.=calcined. *c* F=Flexed. Unless otherwise stated the position is flexed.

Summary of the record of the graves *(concluded)*

Burial	Pit	Depth in inches	Orientation: Face	Orientation: Skull	Orientation: Side	Position[c]	Sex	Condition[b]	Objects	Position
LVIII	103	22	W	N	R			D	Pot	At occiput
LIX	104	24						E		
LX	105	24						E	Pipe, pot	Indeterminate
LXI	106	56						E	Pot	Indeterminate
LXII	107	42	SE	SW	R		M	C	Pot, flints, bear's skull	At occiput
LXIII	109	38	S	E	L			D		
LXIV	110	38	S	E	L			D	Pot	Top of skull
LXV	111	40	S	E	L			C		
LXVI	112	72	N	E	R		F	D	Pot	At occiput
LXVII	113	63	S	W	R			C	Pot, ocher	Before face
LXIX (a)	114	54	N	E	R		Ad(F?)	D	Pot	Between skulls
(b)	114	54	N	E	R		Inf	D		
LXX (a)	115	42	SE	NE	L		F	D		
(b)	115	42	SE	NE	L		Inf			
(c)	115	42	SE	NE	L		"			
LXXI	116	60	W	N	R		M	D		
LXXII	117	58	SW	SE	L		M	C	Pot, flints, steel etc.	Occiput etc. (see records)
LXXIII (a)	118	48	SE	SW	R					
(b)	118	48	NE	SE	R					
LXXIV (a)	119	36	S	W	R			D	Pot	At occiput
(b)	119	39						D–E	Pot	At occiput
LXXV	120	42	S	W	R		M	D	Pipe	Near sternum
LXXVI	121	42					M	D	Flints	Near sternum
LXXVII	122	48								
LXXVIII (a)	123	48	S	E	L		F	D		
(b)	123	48	S	E	L		F	D	Pot	Occiput
(c)	123	54					Ad		4 round pebbles	Around skull
LXXIX	124	42	S	W	R		M	D		
LXXX	125	30						E	Charred bark	
LXXXI (a)	126	48	SW	SE	L		M		Pot	At occiput
(b)	126	48	NW	NE	R		M		Pot	At top of head
LXXXII	127	48	W	S	L		M	D	Pot	At top of skull
LXXXIII	128	49	N	E	L		F	D	Pot	At occiput
LXXXIX (a)	129	42	up	SE	R		F	D		
(b)	129	42	NE	SE	R			D		
XC	130	52	NE	SE	R		F	D	Copper rings	On fingers
XCI	131	40	N	E	R		F		Pot	At occiput
XCII	132	47	SW	SE	back		F	D	Celt	Top of skull
XCIII	133	39	W	S	L		F	D	Pot, flints, shell beads, etc.	Occiput, face, neck etc. (see records)
XCIV	134	42	E	S	R		F	D		
XCV (a)	135	42	SW	SE	L		M		Pot, flints	Between skulls at female's scapula
(b)	135		up	S	back		F	C		
XCVII	136	48	down	SE	L					
XCVII	137	37	S	E	R		F	D–E		
XCVIII (a)	138	48	NE	SE	R		M			
(b)	138	48	NE	SE	R		F		Flints	Between skeletons
XCIX	139	42	S	E	L				Pot, flints, ocher, copper bead	Top of skull, face, abdomen, feet
C	140	42	S	E	L		M		Pot	At top of skull
CI	141	36	S	E	R		M		Pot, pipe	At face, on arm
CII	142	32	S	E	L		inf	D–E	Pot	Top of skull
CIII	143	32	N	E	R				Red ocher	At occiput
			N	E	R		inf	D–E		
CIV	144	40	N	E	R		M		Flints	Top of skull
CV	145	48						E	Pot	Indeterminate
CVI	146	42	SW	NW	R		F	D	Pot	Before face
CVII (a)	147	45					F	D–E	Pot	At occiput
(b)	147	45					inf			

a Ash pit burials. b C=fair, D=poor, E=entirely disintegrated, Cal.=calcined. c F=Flexed. Unless otherwise stated the position is flexed.

Significance of some of the data

From the data secured in the course of the operations one might construct a fairly correct account of the life and activities of the people who left so many significant traces. One might picture the scenes of primitive agriculture, the excitement and dangers of the chase, the industries of the pot maker or the flint worker or the home life of the warrior father, his wife and children, but this picture is left for the reader to produce. Our work is rather to tell how the facts were gathered, and, for the guidance of those who wish to revivify the scenes of the past, to suggest how this may be done. Hasty conclusions and preconceived ideas are to be studiously avoided and no theory should be considered more than tentative unless the proof is so strong as to eliminate doubt.

Indications of an earthwork

Excavations were not carried on long before enough evidence was secured to point out the former presence of a circular earth ring in the village section. This ring seems to have inclosed the main portion of the village and to have separated it from a group of pits and lodge sites to the south. Just beyond pits 26, 27, 78 and 79 the soil became very hard and compact and the occupied soil covered with a layer of sand and gravel. The earth in the center of this belt was hard and compact. It was evidently disturbed and intermixed but exhibited few signs of modification by the substances incident to human occupation such as ashes and charcoal. A few inches of the disturbed subsoil overlay the occupied soil on either side of the barren belt [*see* text fig. 18]. From these facts it was inferred that at some time an earth ring or wall had been leveled down and the earth of which it was composed thrown

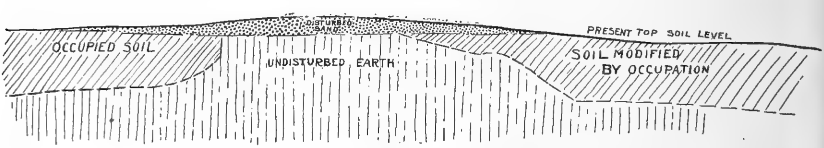


Fig. 18 Cross-section of soil beneath obliterated earth ring

over the occupied soil. The outline of the belt was traced and found to be circular in form or rather crescentic, the ends of the belt touching the lake bank. The original form had undoubtedly been circular, the encroaching lake having undermined the cliffs

which, falling, had carried away a part of the village site and with it the missing portion of the ring [*see* map of village site, pl. 4].

The soil most modified by the occupation, that is to say, the top-soil most deeply stained and intermixed with waste products of aboriginal activities, was that part embraced within the area of the dirt ring. Just outside of this ring there was another occupied layer but it did not extend far. Some time after the discovery of the former presence of the earth wall, on September 4, Mr George Morse, an old settler, visited the scene of the operations and introduced himself as one of the pioneers of Chautauqua county, and as a man who in his boyhood remembered the site and its features. Mr Morse made a verbal statement to the Archeologist which was taken down verbatim. The account was afterward read to him and pronounced correct. The statement follows:

STATEMENT OF GEORGE MORSE RELATING TO THE EARTH RING

Taken verbatim

I was born in 1823 a half mile from Dewey knoll and as a child remember the Indian fort ring here. It was breast high and as round as a cart wheel. My father said it (the inclosure) was covered with a second growth whitewood woods. All around the circle several rods from its edge was the primeval forest which was cleared away by Mr Dewey,— he owned the land once. To be precise I remember that the ring was not complete for the two ends like the letter C touched the lake bank.

Since the earliest days relics have been carted away. When the stumps were pulled and whenever the grub hole struck, arrows and " skinning stones " would come to light. Sometimes Indian crockery (pottery) in pieces as big as your hand and bigger would be found.

I remember it was as round as a cart wheel and was plowed down to level it off. My father planted corn there in 1826 and he plowed and dug it level. There was a stone mound covered with earth there. My brothers dug into it but did not dig deep enough I think. Finally the bank caved off,— caves off every spring a good deal, and a part of the mound fell into the water. Then when we looked at it we saw a skeleton exposed under it. Shortly the entire mound went over into the lake.

The earth ring is found in many places in western New York and elsewhere and is the base upon which a line of sharpened stakes or palisades was placed to fortify the enclosure. This being true, the village here must have been within the circular walls of sharpened posts that rose from the earth circle. A number of families probably had lodges outside the fortification. These may have been the less cautious or those who were crowded out through lack of space within the narrow confines of the picket wall.

Post holes and lodge sites

A large number of post holes, that is small holes from 18″ to 24″ deep, filled with substances somewhat different from the surrounding soil, were discovered in the village layers [*see* diagram of pits, pl. 4]. The positions of these holes were carefully charted and were found to bear a certain relation one to the other. The character of the soil inclosed by lines bounding these holes was carefully noted and seemed to indicate the dirt floors of lodges. The post holes therefore, were probably the holes made by the stakes that formed the uprights of dwellings. Although a number of lodge sites, so called, were discovered it is not to be thought that there were not other lodges elsewhere.

Mortuary customs indicated

The areas of most of the graves were large in proportion to the space occupied by the skeletons. In general the bones rested in the center or at one corner of the excavation, leaving a wide space about the bones. Nearly all the skeletons were arranged in a flexed position. From these circumstances it might be inferred that the dead were carefully placed in the graves and arranged by persons who descended into them. This assumption appears strengthened when it is considered that the pottery vessels which probably contained food could not have been easily dropped into the grave and have remained upright as they were in almost every instance. The whole make-up of the graves and the positions of the articles found in them indicate the hand of design. The decayed substances found over the grave bottoms seem to indicate that other perishable possessions were placed in the graves, such as articles of wood, bark, skins and fabrics of bark or reeds. It is not to be supposed that objects were not placed in some graves because none were found. The lack of stone or pottery articles suggests that only perishable substances and utensils have been interred. In the bottoms of many of the grave pits just beneath or mingled with the animal phosphate were layers of charred vegetable matter, either bark, grass or reeds. From this fact it would appear that in such pits fires had been kindled, either to dry the damp earth or to warm the bed for the sleeper whose body must rest so long within it. This is in accord with certain traditions. Thin and sometimes almost imperceptible layers of decayed vegetable matter over some of the skeletons strongly suggests the use of bark or wood as a covering for the bodies before the earth was finally thrown back into the excavation. In a few cases flat pieces

of charred bark were found above the bones. The use of a bark or animal skin covering is also suggested by the finds in grave LI, pit 96, where above the copper bracelets a fragment of bark and a piece of deerskin were found preserved by the copper salts. When it is considered, moreover, that a primitive people would naturally reverence the dead it seems highly probable that they would shrink from casting clods of clay or masses of mud upon the form of those whom they had evidently arranged and dressed with every manifestation of solicitude. Moreover, to have covered the corpse with a shroud of skin or a covering of bark would have added an element of mystery to the interment. The body would have been obscured during the process of burial. To cast stray stones and earth upon the form beneath would have shocked the primitive people to whom care for the dead was probably an important religious rite. If the vessels of clay contained food for the skyward journey it would hardly seem that this food would have been tainted by earthly flavors, but rather covered for cleanliness. This supposition seems to be given weight by the fact that two pots were found in the clay stratum over the mouths of which were wads of clay, the vessels being empty. From the fact that weapons and utensils were buried one is led to think that the people believed or affected to believe that these things, or perhaps the spirits of these things, would be of value to the spirit of the dead. All the clay pipes from the burials contained charred tobacco and from this fact it might be conjectured that the pipe of the sacred herb had been lighted in the grave for a consolation to the spirit as it started out in the new and strange world of spirits.

The positions of the various objects, especially of the pottery vessels are highly interesting. Most of them were near the head as were some of the pipes. The table appended herewith gives a summary of the positions of the pots in relation to the skeletons.

Position of the pots

Before face, 11; at occiput, 25; top of skull, 16; near abdomen, 1; at pelvis, 1; between skulls, 2; indeterminate, 14.

Graves in ash pits. Two graves were found in true ash pits. These pits were situated just beyond and outside the earth ring and were side by side [*see* record of pits 48 and 49]. Both pits were shallow, 2½′, and the skeletons had only light covers of charcoal and ashes to separate them from the ordinary pit refuse. It may be possible that the ash pits were within or near a lodge site and

were used as graves when the ground elsewhere was frozen. Broken pots were found in both of these graves.

Primitive means of excavating. Trowellike implements of antler were found in several ash pits and were probably the tools used for digging pits and graves. The sand might have been easily loosened with picks of antler or wood or with the shoulder blades of elk or deer and have been scooped up with shallow bark baskets.

The grave fillings in at least 40 cases were heavily intermixed with carbonized wood and bark. This suggests that the topsoil had been thawed out to facilitate digging in winter.

Depth of graves. In most cases the graves were dug as deep as it would be possible with rude implements. This depth was to the clay stratum or into it for a few inches. Because of the poor drainage of the clay the skeletons buried within it decayed much more rapidly than those in the loose sand. A table of depths follows:

Table of depths of graves

Inches	No. of graves	Inches	No. of graves	Inches	No. of graves
10	2	36	3	51	2
20	1	37	2	52	3
22	1	38	6	53	1
24	4	39	2	54	2
25	1	40	7	55	1
28	1	42	21	56	2
29	1	45	1	58	1
30	6	46	1	60	4
32	3	47	1	63	1
33	1	48	15	72	1
34	1	49	3		

Arrangement of graves and position of skeletons. An examination of the map of the burials shows that apparently no fixed system of plotting the graves was observed. The graves seem to have been dug where the sand was softest and most easily excavated. It will be noticed, however, that the graves cluster about open spaces. From this it might be inferred that they were arranged about a large tree that afterward decayed.

An examination of the table of orientation reveals that the bodies were not apparently arranged to face any particular cardinal point. This, however, does not necessarily indicate the lack of system. It may be that the position in which a person died governed the position in the burial.

Orientation by direction of head [1]

HEAD NORTH		
Face west on the right side		
6F, 8, 11M, 116M	4	
Face east on left side		
14M, 102M	2	
Total		6
HEAD EAST		
Face north on right side		
40, 68juv, 86M, 91, 94, 101F, 112F, 114:1, 114:2, 128, 131F, 137M, 143:1, 143:2inf, 144M	15	
Face south on left side		
47M, 48F, 52, 92M, 96:1F, 96:2juv, 96:3juv, 109, 110, 111, 123F, 123:2F, 139, 140M, 141M, 142inf	16	
Total		31
HEAD SOUTH		
Face east on right side		
4, 7F, 22juv, 45F, 51M, 134F	6	
Face west on left side		
13, 44M, 89, 90, 98, 100M, 127M	7	
Face up on back		
135:2	1	
Total		14
HEAD WEST		
Face south on right side		
99, 113, 120, 124M	4	4
HEAD NORTHEAST		
Face northwest on right side		
15M, 65, 126:2M	3	

[1] The numbers refer to the burials and the letter following to the sex, thus, M, male; F, female; inf, infant, and juv, juvenile. Where there is no letter the skeleton is probably that of an adult, the sex being indeterminate on account of the condition of the bones.

Face southeast on left side		
115: F, 115:2inf, 115:3inf	3	
Total		6
HEAD NORTHWEST		
Face southwest on right side		
39	1	1
HEAD SOUTHWEST		
Face southeast on right side		
93inf, 107M, 118:1	3	3
HEAD SOUTHEAST		
Face northeast on right side		
9M, 63M, 67, 94:2, 118:2, 129:1 (face up)F, 129:2F, 130F, 138M, 138:2F	10	
Face southwest on left side		
117M, 135:1M, 136 (face down), 132	4	
Total		14
Not determined	34	34
Total		113

Morphological characters

Field measurements of the bones indicate that the people were of medium hight, 5 feet 7 or 8 inches being the average. A few skeletons were found that approached 6 feet. That the race was stocky is shown by the heavy development of muscular ridges, especially in the case of males whose bones were generally large.

The loose sand affording good drainage preserved the bones when they were not buried directly upon the clay stratum but in either case by the shifting of the sand or through some other agency, most of the skulls were broken or crushed while other bones were in a much better state of preservation. Some of the complete skulls are of unusual interest. In form nearly all are either dolichocephalic

Plate 16

Top and side views of skull from grave XCVIII

Plate 17

Four views of an adult female cranium from grave XCII. Note, Y-shaped lesion in frontalis, see front view; dolichocephaly shown in top view; wormian bones and sutural formation in back view; small alesphenoid and facial angle in side view

or subdolichocephalic, none being of the brachycephalic type common to the mound-builder region 100 miles to the west. A considerable proportion of the skulls in Erie sites 40 miles east is characterized by alveolar prognathism, but among those found at Ripley only two showed this development. The *os incae* was observed in a few instances and there were some skulls having wormian bones [*see* pl. 17]. In one skull the *os japonicum,* that is, the lower portion of the malar bone when divided by a suture, was observed.

The average capacity of the skulls is 1587 cubic centimeters for males and 1440 for females. The average cephalic index would be perhaps 74.4 and the nasal index 47. A careful study of all the morphological characteristics will be made in the laboratory and reported in another place and may slightly modify the averages here given.

In a few cases humeri were observed in which the olecranon cavity was perforated. In two cases an examination of the femora revealed the process termed the third trochanter and the hypotrochanteric fossa. Some femora are platycnemic.

Pathological conditions

With the exception of two cases of ankylosis, no pathological conditions were noted. There are a number of bones, however, that show the repair of breaks.

Only in a few cases were possible clues to the cause of death discovered. In several skeletons triangular arrow points were found between the vertebrae or in some other part of the osseous structure. A remarkable form of ankylosis was observed in the case of an aged male whose entire spine had become cemented into one solid bone. Such conditions are probably rare in Indian skeletons. One low type female skull marked by prognathism and wormian bones had the frontal bone crushed and the perforation filled and repaired by osseous matter. If it is permitted to judge character from the form of the skull one would be strongly tempted to say that the deceased must have been no congenial companion, to say the least [*see* pl. 17].

Identity of the inhabitants

Eries

The general type of the artifacts discovered in the course of the excavations, especially the types of the pottery, closely resemble Iroquoian forms. In particular they resemble the Erian. The fact that pieces of iron and copper were found in graves and ash pits

proves that the former inhabitants of the site had contact, direct or indirect, with Europeans. That few objects of European metal were found and no glass beads save a fragment of one indicates that the people acquired them from a single trader or by trade from other Indians. This latter conclusion in the light of evidence seems the more probable. If the inhabitants of the site had contact, direct or indirect, with the whites, then we may look for historical records by which we may identify them. In the Jesuit Relations are found many references to a people who inhabited the region of which the Ripley site forms a part. These people are variously called Eries, Eriegoneckkak, Eriehronnons, Erieé, Riquehronnons, Rhiier, Nation des Chat, Cat Nation, Rhiierrhonnons, etc. etc. Besides the accounts by the Jesuits there are several maps which place the Erie Indians in this territory, notably the maps of Sanson of 1656 [*see*

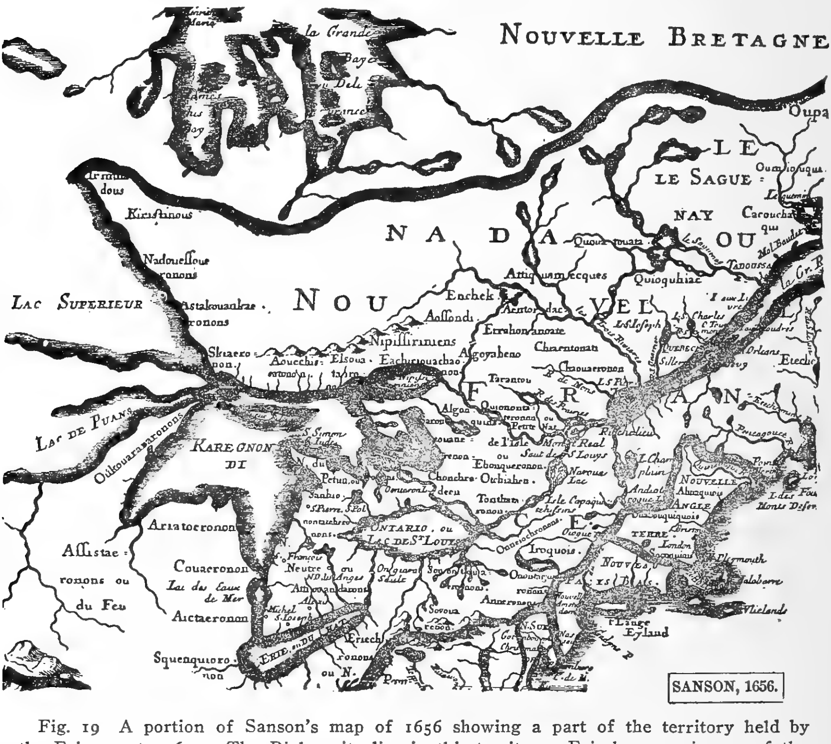


Fig. 19 A portion of Sanson's map of 1656 showing a part of the territory held by the Eries up to 1654. The Ripley site lies in this territory. Eriechronons is one of the names for the Eries frequently used by the early French explorers and missionaries.

fig. 19], of Creuxius of 1660, of LaHontan of 1690, and of Hennepin of 1698. From these records and maps we may define the territory of the Eries as the region bordering the southern shore of

Lake Erie between the region of the Neutrals on the eastern end of Lake Erie east to the western banks of the Genesee, westward to the western watershed of Lake Erie and the Miami river and southward to the Ohio river. In the Relation of 1647–48 we find the following description of the Erie country:

This lake, called Erie, was formerly inhabited on its Southern shores by certain tribes whom we call the nation of the Cat; and they have been compelled to retire far inland to escape their enemies, who are farther to the West. These people of the Cat Nation have a number of stationary villages, for they till the soil and speak the same language as our Hurons.

Under title of "Description of the Country of the Hurons" in the Relation of 1653 there is the following paragraph:

Beyond that same neutral nation, in a direction nearly South, there is a lake 600 miles in circumference, called Herie, formed by the fresh-water sea, which discharges into it,— and thence by means of a very high cataract, into a third lake still greater and more beautiful; it is called Ontario or Beautiful Lake, but we were wont to call it the Lake of Saint Louis. The former of these two lakes was at one time inhabited toward the south by certain peoples whom we call the Cat Nation; but they were forced to proceed further inland in order to escape the enemies whom they have toward the West. This Nation has various territories, cultivates the fields, and speaks a language similar to the Hurons.

In the Relation of 1654 there is still further reference:

They (the Iroquois) tell us that a new war has broken out, which fills them with fear, that the Eries have taken arms against them (we call the Eries the Cat Nation, because there is in their country a prodigious number of wildcats, two or three times as large as our tame cats, but having a beautiful and precious fur). They tell us that an Iroquois town has already been set on fire and destroyed at the first attack; that this nation pursued one of their armies which was returning victorious from the shores of Lake Huron, fell upon the rear guard of 80 picked men and entirely cut it to pieces; that one of their most distinguished chiefs, Annenraes, has been taken prisoner; in a word that the Iroquois are inflamed, and are arming to repulse the enemy, and are, therefore, obliged to seek peace with us.

This Cat Nation is very populous. Some Hurons, who have scattered everywhere since the destruction of their country, have joined them, and excited this war, which alarms the Iroquois. It is said that they have 2000 men, good warriors, though without firearms. But they fight like the French, enduring courageously the first discharge of the Iroquois who have firearms, and then pouring down upon them a hail of poisoned arrows, which they can shoot off six or eight times before the others can reload their muskets.

Sagard, who went to the Huron country as a missionary in 1623, in his interesting *Histoire du Canada,* 1636, has also some notes bearing on the Eries.

Relation of the Eries to other Iroquoian tribes. The Eries belonged to the Huron-Iroquois linguistic stock as is patent from a review of the records. William M. Beauchamp, the distinguished authority on New York archeology, suggests that the Eries were the parent stock of the Huron-Iroquois family and further suggests that the Senecas were derived from them, possibly within historic times. There seems to be some good base in history for this opinion and the argument can not be better stated than in Dr Beauchamp's own words, quoted from his address on *The Origin and Early Life of the New York Iroquois,* delivered before the Oneida Historical Society in 1886.

The Senecas had a conspicuous place in the Iroquois league, though the last to enter it, forming the west door, as the Mohawks were the east. On the Dutch maps of 1614 and 1616, the Mohawks and the Senecas are alone designated, and for 50 years more the Dutch hardly mentioned any but these. That they were kindred to the Eries is conceded. In 1615 Champlain spoke of the Iroquois and the Entouhonoronons, whom some have thought the Senecas. In the explanation of his map it is said that "The Iroquois and the Antouhonorons make war together against other nations except the Neutral nation." They had 15 strong villages, too many for the Senecas, unless the Eries were included. That the Senecas differed from the other Iroquois in religious observances, totems and clans, habits of life and other things is very clear. A marked distinction appears in their language and they were not very brotherly to the rest. Long after the League was formed they were sometimes at swords points with the Mohawks, and the French Mohawks did not hesitate to go against the Senecas, when they refused to fight against the other nations.

There is good reason for thinking them part of the Massawomekes of Captain John Smith's narrative. Early writers made these any part of the Five Nations, but later students, to identify them, as in the case of the Entouhonorons, with both Eries and Senecas, these being firm friends until 1653. Captain John Smith met these fierce enemies of Powhatan in their bark canoes on Chesapeake Bay in 1608. The general description is that of an Iroquois war party, though the name of course is Algonquin. That he did not understand their language makes this almost certain. He bought some of their weapons and increased his reputation by showing these, the Virginia tribes supposing he had taken them by force. But a Maryland trader went to the Massawomekes in 1632, and there remains no doubt that this name included the Eries and the Senecas, then or previously allied. They had palisades of great trees about their villages with galleries at the top. . .

Destruction of the Eries. One of the most picturesque and tragic accounts of these people is given in the Relation of 1655–56. It is the story of their destruction. In the account they are called the Cat nation (La Nation du Chat). The Jesuit account is without doubt essentially correct and differs in many respects from the rather fanciful Seneca tradition. In one particular both accounts agree and that is that the Eries brought destruction upon themselves by their own folly.

The account as given in the Thwaite's edition of the Relations follows:

CAUSE OF WAR AGAINST THE CAT NATION

The Cat Nation had sent 30 Ambassadors to the Sonnontouahronnons to confirm the peace between them; but it happened that by some unexpected accident, that a Sonnontouahronnon was killed by a man of the Cat Nation. This murder so incensed the Sonnontouahronnons, that they put to death the Ambassadors in their hands, except five who escaped. Hence the war was kindled between those two Nations, and each strove to capture and burn more prisoners than its opponent. Two Onnontagehronnons among others were captured by men of the Cat Nation; one of them escaped and the other, a man of rank, was taken home by the enemy to be burnt. He pleaded his cause so well that he was given to the sister of one of the 30 Ambassadors who had been put to death. She was absent from the village at the time; but the prisoner was nevertheless clothed in fine garments, and feasting and good cheer prevailed, the man being all but assured that he would be sent back to his own Country. When she to whom he had been given returned, she was told that her dead brother was to be restored to life, that she must prepare to regale him well, and then to give him a most gracious dismissal. She, however, began to weep and declare that she would never dry her eyes until her brother's death was avenged. The Elders showed her the gravity of the situation, which was likely to involve them in a new war; but she would not yield. Finally they were compelled to give up the wretched man to her to do with him as she pleased. All this occurred while he was still joyfully feasting. Without a word he was taken from the feast and conducted to this cruel woman's cabin. Upon entering he was surprised at being stripped of his clothes. Then he saw that his life was lost, and he cried out, before dying, that an entire people would be burned in his person, and that his death would be cruelly avenged. His words proved true; for no sooner had the news reached Onnontague, than 1200 determined men started forth to exact satisfaction for this affront.

We have already observed that the Cat Nation is so called from the large number of Wildcats, of great size and beauty in their country. The Climate is temperate, neither ice nor snow being seen in the winter; while in summer it is said that grain and fruit are harvested in abundance, and are of unusual size and excellence.

Our Warriors entered that Country remote though it was from Onnontague, before they were perceived. Their arrival spread such a panic that villages and dwellings were abandoned to the mercy of the Conqueror,— who after burning everything, started in pursuit of the fugitives. The latter numbered from two to three thousand besides women and children. Finding themselves closely followed, they resolved, after five days' flight to build a fort of wood and there await the enemy who numbered only 1200. Accordingly, they intrenched themselves as well as they could. The enemy drew near, the two head chiefs showing themselves in French costume, in order to frighten their opponents by the novelty of their attire. One of the two who had been Baptized by Father le Moyne and was very well instructed, gently urged the besieged to capitulate, telling them that they would be destroyed if they allowed an assault. "The Master of life fights for us," said he; "you will be ruined if you resist him." "Who is the Master of our lives?" was the haughty reply of the Besieged. "We acknowledge none but out arms and our hatchets." Thereupon the assault was made and the palisade attacked on all sides; but the defence was as spirited as the attack, and the combat was a long one, great courage being displayed on both sides. The Besieging party made every effort to carry the place by storm, but in vain; they were killed as fast as they advanced. They hit on the plan of using their canoes as shields; and bearing these before them as protection, they reached the foot of the entrenchment. But it remained to scale the large stakes, or tree trunks of which it was built. Again they resorted to their canoes, using them as ladders for surmounting the stanch palisade. Their boldness so astonished the Besieged that, being already at the end of their munitions of war,— with which, especially powder they were but poorly provided,— they resolved to flee. This was their ruin; for, after most of the first fugitives had been killed, the others were surrounded by the Onnontaguehronnons, who entered the fort and there wrought such carnage among the women and children that blood was knee deep in certain places. Those who had escaped, wishing to retrieve their honor, after recovering their courage a little, returned to the number of 300, to take the enemy by surprise while he was retiring and off his guard. The plan was good but it was ill executed; for frightened at the first cry of the Onnontaguehronnons, they were entirely defeated. The Victors did not escape heavy losses,— so great indeed, that they were forced to remain two months in the enemy's country, burying their dead and caring for their wounded.

The Eries are commonly said to have been exterminated but this is not entirely true. They became exterminated only in the sense that they ceased to exist as an independent people. The surviving Eries who did not flee to other tribes became the captives of the Iroquois, who in accord with their usual policy adopted the individuals into their families and gradually absorbed them.

Date of occupation. From the testimony of the records it would thus appear that the inhabitants of the Ripley site must have been Eries. The testimony of the relics leads to the conclusion that this occupation was of the early historic period. Without doubt the site bridges the prehistoric to the historic. That it must have been earlier than 1654 is known from the fact that the Eries were expelled from their territories by the confederated Iroquois in 1654. That it is not as late as 1654 appears from the fact that by this date the Eries had opportunity to trade extensively with Europeans and yet few European articles were discovered. Other Erie sites, notably one forty miles east, known as the Silverheels site on the Cattaraugus reservation, explored by Prof. M. Raymond Harrington and the author in 1903, contained great quantities of European artifacts and metal. From the time the Dutch entered New York and the colony of Jamestown was settled, the Eries had opportunity to acquire articles by trade with other Indians, especially the Iroquois. Considering all things one would be strongly led to place the date of the cession of occupation before 1610. It is highly probable, moreover, that the first occupation of the site was early in the 17th century if not during the last few years of the 16th.

Description of implements

Stone

Objects of rough stone

The rough and massive stone objects requiring but slight modification from natural forms to adapt them to the purposes intended, include hoes, anvils, shaft rubbing stones, pitted hammer stones, lapstones, net sinkers, rounded pebbles, mortars and some celtlike implements.

Figure 1 in plate 19 illustrates a flat piece of shale which has been roughly shaped and from its marks of use evidently has been used for a digging implement, perhaps a hoe. Objects of this class were not common, this specimen being the only complete one found on the site. Large numbers of rounded water-washed pebbles were found distributed over the site. All had been brought from the lake shore and they were not found in the undisturbed soil. These pebbles varied in size from 2 inches to 5 inches in diameter and most of them show signs of use. Many seem to have been heated in fires and others to have been used as hammers or anvils. Round pebbles were also found in the graves but nothing there was discovered

that might furnish a clue to their employment. Figure 2 in plate 19 shows one of these pebbles.

Most polished stone articles seem to have been reduced from crude forms by a picking process. Few implements resembling picks, perhaps, have been found. One crude implement, figure 3, plate 19, is of tough granite and seems to have been one of these picks. It is much battered and shows signs of long use. Notched implements, commonly called net sinkers were not common, only about a dozen being found. They were of the ordinary type found everywhere throughout New York. Figures 4 and 6 in plate 19 show two net sinkers typical of all the rest found on the knoll. Hammer stones were everywhere numerous both on the surface and in the pits. Hammers were of three types, the ordinary round pebbles used as hammers, the ball-like hammers that are battered on almost every part of the surface and the common pitted hammer stones. Some of the larger pitted stones seem to have been alternately hammers and anvils and sometimes resemble small mortars. Figure 10 shows one of this type. Objects termed anvils are the flat stones plentiful everywhere in the village site. They exhibit signs of having been used as bases upon which other stones were worked. Anvils were generally pieces of hard shale or small boulders and most of them seem to have been used for long periods [*see* fig. 8]. The flat slabs of shale and sandstone anvils sometimes had shallow hollows on one side and seem to have been used for grinding purposes. It is highly probable that in that state of primitive culture when everything convenient must be utilized, one utensil served as many purposes as could be devised for it.

A number of smoothed and worked stones found in refuse pits and also in graves are thought to be potters tools. One was found in a pit containing a large quantity of partly worked clay. One of these stones is shown in figure 9 in plate 19 and another in figure 7, plate 25. One interesting specimen of a massive stone implement is the large mortar found in pit 50. It weighs about 200 pounds and was found at one end of a stone-floored pit. It must have been occasionally turned over for both sides show signs of use though only one side was used as a mortar. Mullers or rounded pebbles must have been used to crack and grind the corn or other substances. Long cylindrical pestles would not have served the purpose. Four small celtlike implements were found in refuse pits. These had been formed from natural water-washed pebbles the ends of which had been sharpened to an edge, this being the only work done to form the implement. It is hardly possible to state

definitely for what purpose these miniature celts were used. Certainly they could not have sustained rough usage [*see* fig. 9, 11, pl. 20].

A grooved stone sometimes called an arrow shaft smoother is figured in text figure 20.

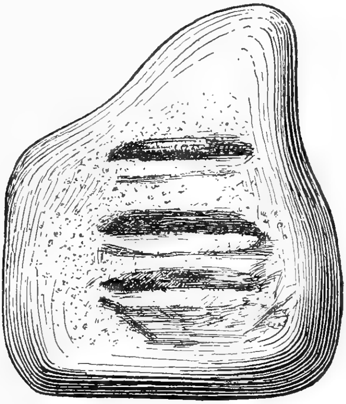


Fig. 20 Arrow shaft rubber and polisher

Polished stone objects

No polished stone articles of the type usually termed ceremonial were found in the course of the excavations although a gorget was found on the hill to the east of the site, unless the very interesting polished bar of Portage shale found in grave 96 is to be called a ceremonial [*see* pl. 20, fig. 4]. There is a bar of this description in the museum collection which came from Jefferson county and the writer secured another 15 inches long from Mayville, Chautauqua co. All of these specimens have sharpened ends like celts and for the want of a definite name the writer proposes the term "bar celt."[1] Thruston in his *Antiquities of Tennessee* in plate 16 figures an implement resembling a bar celt. He describes it as the ". . . . long delicate crescent-shaped 'implement' of highly polished syenite, represented in plate XV (author's collection), also probably belongs to the ceremonial class. It is 11½ inches long. Originally it was probably 12 inches as the point has been broken. It was found by Theodore Haslem in North Nashville (Tenn.)." Objects of this kind are probably rare and but few have been described. All three specimens in the State collection are flattened on the bottoms and rounded over the back with gradually tapering ends.

1 The writer has since examined another bar celt found by Mr. William T. Fenton of Conewango Valley.

The ordinary celts are of the usual type found everywhere in the Erie cultural area and in general throughout the Iroquoian. Most of the specimens are equilateral, there being none of the adz, "flat-bellied" or "turtle-backed" forms. The majority of celts were found in graves although a few are from refuse pits. Three entire celts and two broken celts were found in a "feast pit" previously described [pit 80]. One small double edged or "bitted" celt is shown in text figure 13 [also fig. 13, pl. 20], and came from grave 92.

A stone press. One of the most interesting objects of worked stone found in the vicinity of Ripley is a stone press, probably used for pressing the juice from small fruits. The bottom portion is hollowed out and has a Y-shaped groove incised in the bottom. The base of the Y runs out into a lip from which the liquid or juice was designed to be poured. The upper portion fits exactly into the lower. This utensil is from the collection of William A. Spears which was purchased for the State Museum. The writer has never seen a press of this kind before in any collection and the specimen is probably unique [*see* pl. 21].

Stone tobacco pipes

The stone pipes are perhaps the most interesting forms of polished stone articles. Those discovered exhibit many interesting features.

Two pipe bowls carved from sandstone are of interest [pl. 22, fig. 2, 3]. Figure 2 is bell-shaped with notches cut around the edge and a cross cut in the rounded bottom of the bowl. In Joseph D. McGuire's *American Aboriginal Pipes and Smoking Customs*, contained in the National Museum Report of 1897, page 428, figure 52, is figured a pipe from Accotink, Va. very similar to this specimen. Of these pipes Dr McGuire says:

> Among the bowl pipes of vaselike form they are found to vary from those which are as broad as they are long, specimens having a hight four times as great as their diameter. This type is usually made from steatite, or kindred stones, capable of resisting heat, though, as with most American pipes, there are numerous exceptions to the rule. One in the Smithsonian collection, of gray sandstone was found in a cave on Tar river, Yancy co., North Carolina, and another found in a kitchen heap in Kanawha county, West Virginia, which was made from a brown stone. Other specimens are known of this type made from partially decomposed limestone, feldspar, and even fossil coral. The writer is informed by the Rev. W. M. Beauchamp that this type is frequently encountered in Onondaga county, New York.

Pipes of this urn-shaped type are found also along the headwaters of the St Lawrence, *on the south* shores of Lake Ontario and Lake Erie, and along the upper waters of the Ohio and its affluents, a typical specimen being from Accotink, Virginia, while yet other specimens in the United States National Museum collection are from New York, Pennsylvania, Ohio, West Virginia, Kentucky, Tennessee, Indiana and North Carolina.

If the area of distribution of the urn-shaped pipe is compared with the tribal distribution first known to the whites, as it appears on Powell's linguistic map, it will be seen that this especial form of the bowl pipe is found in Iroquoian territory on the north, through the Algonquin on the south into the southern Iroquoians. It should be remembered that this area corresponds, reasonably, with the territory influenced by French trade before the advent of the English. The territory is also in the line of travel from the St Lawrence to the Ohio. The writer is unable to determine how far this urn-shaped type of pipe has been governed by European influences. Its contour is similar to pottery bowls from Tennessee, specimens of which are in the United States National Museum collection.

Figure 3, pl. 22 is of an egg-shaped pipe bowl of the same material as the one just described. Around the middle of the bowl is a groove which meets at the stem hole. In Moorehead's *Prehistoric Implements,* page 334, is figured one of these pipes from the Ohio valley. Moorehead remarks that its peculiarity lies in the fact that it is grooved around the center. There is nothing in either of these pipes to suggest European influence as far as the writer can discover. The drilling and workmanship seem to have been done with stone implements entirely. Figure 4 is a pipe bowl cut from a hardened clay. The surface has weathered black but the underlying color is red. In form the pipe is claw or beaklike and is similar to other forms found in the Iroquoian area. The bowl hole is small comparatively and the stem hole large and conical as is the case with all the pipe bowls of the collection. This pipe is from grave CV and was found with pot no. 471 [*see* text fig. 16]. A small pipe carved from the local shale imitating this form was found in an ash pit, perhaps a grave fire, near this grave. The pipe is pictured in figure 1, plate 22. A small stone pipe with a short neck into which a reed stem was evidently designed to fit is shown in plate 22, figure 7. This pipe is of about the same material as the large clay form pipe and has two parallel lines incised on the underside of the neck. It was found in grave CI, pit 141, and lay on the arm of a male. The pipe represented by figure 6, plate 22 is the only stone pipe of the stemmed type found. It is carved from a species of serpentine and is smoothed and polished. In the process of drilling the stem the drill penetrated too near the base of the bowl and there is a

small hole to be observed in the specimen. The shape of the opening suggests that the bowl had been rubbed down after the stem hole had been drilled and that this hole had been encountered then. The form of the stem hole seems to indicate the use of a metal drill. The grave in which this pipe was found is pictured in plate 15.

Perhaps the most interesting of the pipes is the one shown in plate 22, figure 5. It is clearly the effigy of some animal, probably some mythical monster. Placed face down it appears to be a grazing animal. In this position the hump formed by the bowl suggests a buffalo but the large bulbous tail and the shape of the head do not point to such an animal. The material is rather puzzling. In color it is a bluish white and it appears to be some species of talc or steatite but a test for hardness disproves this. Mr D. H. Newland, Assistant State Geologist, made an analysis and pronounced it to be an Ohio kaolin. The broken granular surface of the pipe near the bowl suggests that it had been molded from a rather stiff clay and the roughened top of the head suggests that a portion has been broken off and that an attempt had been made to smooth it over by rubbing. It has there the appearance of baked pottery the surface of which has been rubbed down. The glazed surface however has not been produced and this suggests that the pipe has been hardened in the fire. Yet while the pipe from these appearances seems to be kaolin it seems remarkable that instead of having the bowl and stem hole molded, as is customary with clay pipes, that these holes should have been gouged and drilled out, as they manifestly were. The hind leg on the side visible in the photograph is incised but on the reverse side the three lines have every appearance of having been molded as if in plastic clay. It may be that the clay was found in a semihardened condition and that it was formed into the pipe by both processes and afterward hardened by firing. The pipe, while the effigy is unusual, does not differ in general form from other effigy pipes found in the region. There is nothing in the workmanship to indicate the use of European tools or influence [*see* description of grave 92 and pl. 11].

One of the interesting features about these pipes is that the bowl capacities are small in comparison with modern European pipes. Probably less tobacco could be contained in one than is held in a modern factory cigarette. The bowls of the clay pipes were a little larger. No tobacco ashes were found in any of the stone pipes.

Objects of chipped flint

Objects of flint were numerous especially in graves where complete outfits for their manufacture were found in several instances.

Complete flint articles were not numerous on the surface although there was an abundance of chips and broken blades. The ash pits contained numbers but the graves the most. The lack of finished points on the surface may be due to the fact that each year as the ground was plowed the arrow points were picked up. The older inhabitants say that bushels of arrows and "skinning stones" have been carried off. It is probable that most of the durable objects left on the surface when the site was deserted by its aboriginal inhabitants have been removed by the white tillers of the soil who followed them at a later period and whose curiosity was aroused by the strange artifacts which were turned up by their plows. At any rate very little was found except below plow depth.

Of the points that might be safely termed arrowheads there were but two that had notched shoulders. With these exceptions all the arrowheads were triangular. The workmanship was good and most of the points were thin and evenly worked. The material in general was gray flint or chert but some points were found made from

Fig. 21 Spear or knife of translucent chalcedony. The only form of this implement found in the site

yellow jasper. Most of the points found on the eastern slope of the knoll were of this material. The various forms of triangular flints are shown in plate 24.

Of the flint blades, not arrow points, only two had notched shoulders. One of these was a beautifully wrought blade, a spear

or a knife, of white chalcedony. It is pictured in figure 21. There were several well shaped oval blades and a few of the so called "leaf shape." Scrapers were fairly common, drills rather rare and spears rarer still. There are a number of forms that may safely be called knives. Plate 23 illustrates the range of forms of the larger flints not arrowheads.

Triangular arrow points are commonly called "war points" and notched and barbed points, "hunting points." It does not necessarily follow, however, that these terms are correct, although quite popularly held. The Ripley Eries as well as those of other sites were great hunters, as is manifest from the great quantities of animal bones found in the refuse pits, and yet at Ripley only two so called "hunting points" were discovered. The great majority of projectile points were of the triangular type and these were found in the ash pits among animal bones as well as in graves with the bones of warriors and women. It would appear therefore, that the triangular points were used for hunting as well as war. Sites of Preerian occupancy in Chautauqua county, and elsewhere in New York, yield only the barbed or shouldered "hunting point," no triangular arrow heads being found. Yet this fact does not point out a people who knew only of hunting and nothing of war. Specific terms defining the use of such implements are, therefore, to be avoided. They are more accurately described by their forms as, *triangular, notched,* etc.

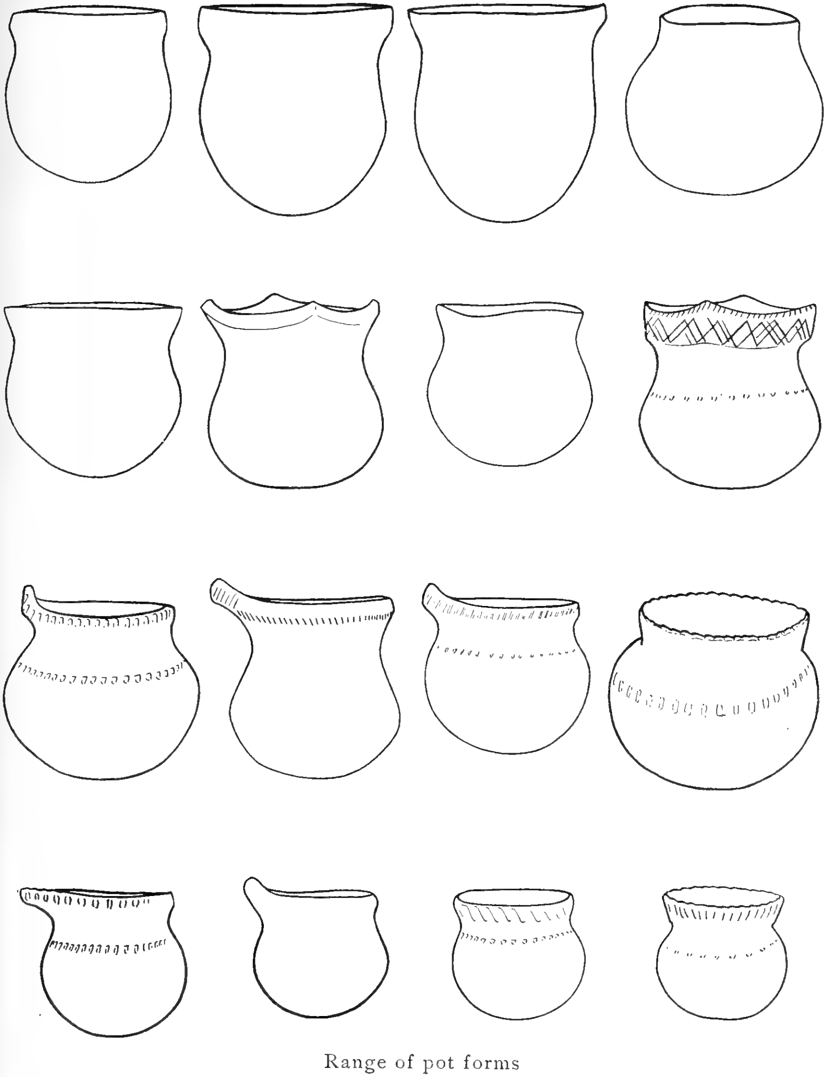
Earthenware

Pottery vessels

All of the entre or nearly entire pottery vessels, save two were found in graves. Most of them exhibited signs of prolonged use. A few seemed to have been especially made for funeral urns and some had been evidently molded in great haste and poorly tempered and baked. Such pots were in every instance broken and the potsherds were soft and flaky, not hard and gritty like good pottery.

The material of which the pots were molded seems to have been the local Erie clay found everywhere in the region overlying the shale beds. The tempering material in all the specimens discovered is invariably pulverized stone, quartz or granitic rock. In no instance is shell to be found. Most of the pots are of a salmon red color varying from a sooty red to a light orange. The majority are stained by smoke and carbonized grease. This charred grease is especially noticeable around the inside of the rim where the in-

Plate 18



Range of pot forms

crustations are sometimes 5 millimeters thick. In thickness the pottery varies from 2 millimeters to 2 centimeters in some fragments. In capacity the vessels range from 5 cubic centimeters in the toy forms found in grave LI, pit 96, to 5 quarts, 4700 cubic centimeters.

The general type of the vessels is Iroquoian but as has been elsewhere stated they differ in many respects from the central New York specimens of the middle 17th century as well as from Erie vessels of that period.

A large percentage of the pots have one raised point that varies from a small knob to a well developed pitcherlike nose. Pots of this type are found in Ontario and Jefferson counties. The form of one of these pots is shown in text figure 22 which gives the shape at different positions. Another characteristic of the pots

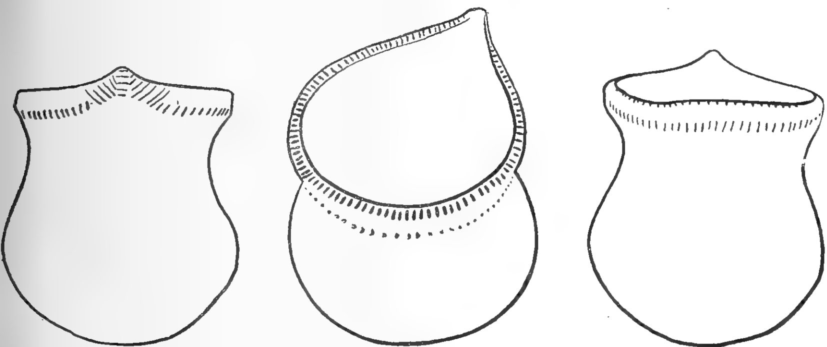


Fig. 22 Three views of pot F 476

from this site is the row of dots that encircles the pot where the belly meets the neck. Cushing's theory that pots with square tops and line decorations about the rim were modeled after bark baskets appears strengthened by some of the forms which had not only decorated square tops but had the stitching imitated by the dots around the neck, as appears on the bark baskets to which Cushing referred.

Pottery clay in masses, tempered and partly worked, was found in a number of the ash pits. Some of these partially worked masses of clay even yet show the imprints of the potter's fingers [*see* pl. 25, fig. 1, 2]. One fragment of a coil was found in an ash pit where it had become hardened and preserved [*see* pl. 25, fig 3]. Several crude partly formed pipe bowls and pot bottoms were found, possibly the work of children [*see* pl. 25, fig. 5, 6]. Most of the pots have smooth surfaces although many were found marked with

a cord-wrapped paddle. Several smoothed paddlelike stones were found in pits containing clay in masses and these are thought to be potters paddles used for working over the surfaces of pots. All have rounded ends and at least one squared side as if to form a blunt scraping edge. One of these implements is shown in plate 25, figure 7. The serrated rib illustrated by text figure 23 may have been used to roughen the surfaces of partly formed vessels to facilitate the process of shaping the wall which was afterwards smoothed.

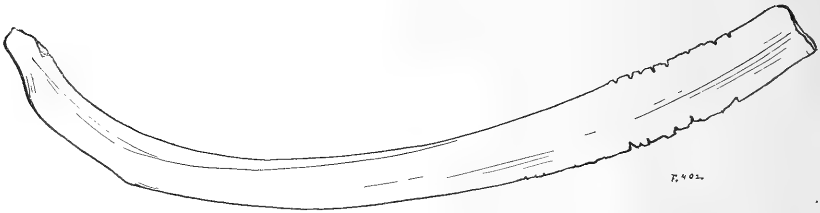


Fig. 23 Serrated rib

No entire pots were found with any trace of color decoration. One sherd was found, however, which has two parallel bands of brown running over a background of yellowish red. Whether this is simply an accident or intentional is hard to determine as the sherd is small. The lower band is well defined and seems to be inlaid into the pottery [fig. 24]. One broken pot found in a grave had an ear like some of the Ohio forms. These two potsherds were the only departures from the usual Iroquoian forms found in the site and suggest contact with other stocks.

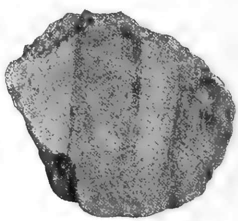


Fig. 24 Sherd

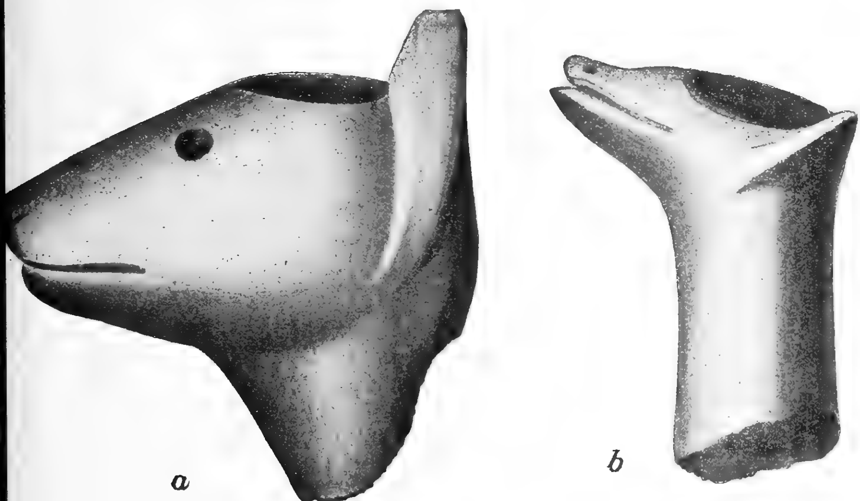
Pottery pipes

Of equal interest with the pottery vessels are the earthenware pipes all of which were found in graves. More than a dozen fragments however were found in ash and refuse pits. The clay pipes are all Iroquoian in form and decoration and are similar to central New York Iroquois pipes of the early part of the 17th century. All of the pipes are gracefully made and reveal an artistic hand.

Figure 1 in plate 31 shows the pipe found in grave 14. The bold incised lines that form the decoration are of exceptional interest and are a departure from other forms. The nipplelike stem seems to have been designed as a support over which a wooden stem was fitted, rather than as a mouth piece. The pipe contained charred tobacco which has been carefully preserved intact in the bowl. A photograph of the grave in which the pipe was found is shown in plate 7. The writer has never seen a pipe of this kind in any collection nor illustrated in any work on archeology, and the specimen is probably a rare one if not entirely unique.

The long square-topped pipe shown in figure 2 of plate 31 is the so called "Huronian" form. It is made of the ordinary clay from the vicinity but has become stained a dark brown. In texture this pipe is perhaps the best example of pottery found in the site. It is very hard and fine grained.

Two views of the two-faced pipe found in grave XX, pit 44 are shown in plate 31, figures 3 and 4. The front view was taken just after the pipe was removed from the grave and was yet covered with particles of sand, as the picture shows. The side view gives a much better idea of the object and shows the two faces, both of



a b

Fig. 25 Pottery pipe bowls

which are remarkably alike, the face away from the smoker, however, being more perfect in workmanship. As is the case with all the earthen pipes shown in the plate, this pipe contained charred tobacco.

The trumpet-shaped pipe shown in plate 31, figure 5, came from grave LXXXVI and was found with pot F446 [pl. 28, fig. 6], and two celts. In comparison with the other stemmed pipes the stem is shorter but does not seem to have ever been broken.

The wide flaring platform-topped pipe shown in plate 31, figure 6, is a modification of the trumpet form. The top or platform is flat and quite perfectly circular. This type is common almost everywhere in the Iroquoian region but particularly so in the Erie region. Many of this type are found in prehistoric Onondaga sites in Jefferson county.

Two interesting pipe bowls in the form of animal heads were found in refuse pits. One is plainly a bear's head and is of polished black clay. The other is of ordinary red clay. It is not easy to decide just what is meant to be represented by the effigy. Some who have examined it have thought it intended for a fox [*see* text fig. 25a, b].

Bone

Articles of bone and antler were particularly numerous and varied. Except for about 10 specimens all came from ash pits.

The great abundance of awls points out their extensive use. The awls were of the usual forms, flat, cylindrical, tubular handled, and those having a joint end. There were also awls made from small splinters. The principal forms are shown in plate 32.

Bone beads were found in every ash pit and varied from crudely broken sections of bird and small mammal bones to well shaped and highly polished cylinders. That so many should have been thrown in amongst the refuse seems rather remarkable and almost seems to indicate something more than accident. These beads ranged from 3/32 inch in diameter to 5/8 inch although the majority were about 1/4 inch in diameter. One form [*see* pl. 33, fig. 5] has the appearance of a handle. The range of forms of the larger polished bone beads is shown in text figure 26.

Perforated elk, wolf and bear teeth were found in refuse pits Perforated bear tusks were found previously by local collectors of Indian relics. Figure 1 in plate 34 is that of a bear's molar. It is a beautiful specimen and highly polished. There were several perforated elk teeth but none with complete perforations. Each had been broken. A perforated turtle shell fragment is shown in figure 11, plate 34, and came from an ash pit. Other broken perforated carapaces were found in graves. The small spatulate implement

shown in plate 34, figure 12, is nicely formed and polished. Perhaps it was a pottery marker. Two polished pieces of bone

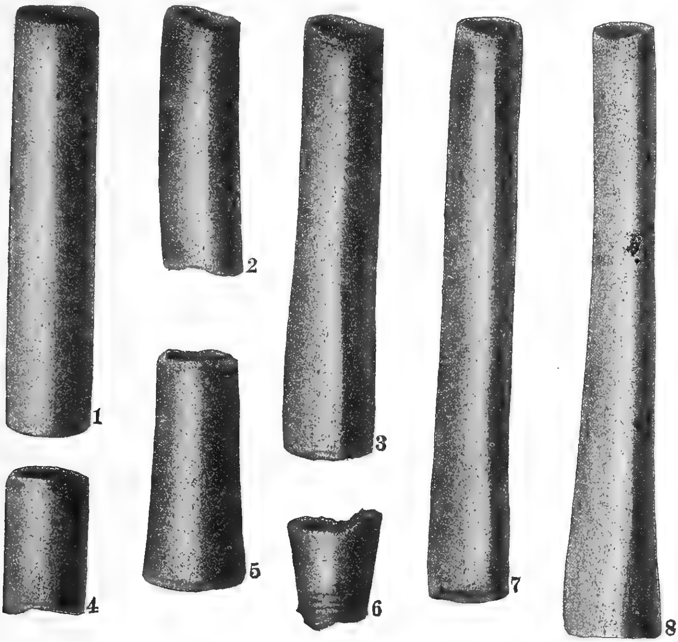


Fig. 26 Bone beads

smoothed on all sides were found in refuse pits. The one shown by figure 13 is grooved on either side. A bone knife blade, the point of which is broken, is shown in figure 14. Raccoon penis bones were found in several pits. All are smoothed and show signs of use, perhaps as hooks for coarse weaving. Figure 21 is that of a long flat bone implement resembling a shuttle. It is a fine specimen, being nicely smoothed and polished. The notch at one end is smoothly worked and shows no signs of being a broken eye. Figure 24 is probably that of a broken bone needle. Needles were rare in the site. Deer phalanges were found in abundance and most of them are worked to some degree [*see* pl. 34, fig. 5, 6]. Numbers were flattened on one side and some were worked down to cones with a perforation at one end, the end nearest the tip. These cones resemble the cups used in the cup and awl game common among the early Hurons and are probably parts of such apparatus [pl. 34, fig. 4, 8].

Beaver teeth seem to have been used for scraping or cutting.

Several specimens are worked smooth at the bases [*see* pl. 33, fig. 1–3]. One has a slot running from the edge well toward the top.

One very interesting specimen is that of a bone fishhook in process. If finished it would have been a small delicate hook. No sign of a barb appears. The specimen resembles some of those figured by Prof. F. W. Putnam in *The Way Bone Fish Hooks Were Made in the Little Miami Valley.*

A pendantlike tube is shown in plate 33, figure 9. Both ends show the marks of cutting as do both of the pendants of deer's jaws shown in the next figures. Plate 33, figure 10 is notched and perforated lengthwise.

It is perhaps not customary to rank deer jaws as implements. Nevertheless the Senecas up to within the last 10 years have used them when they could obtain them, for scraping corn from the green cob. The sharp teeth were raked over the kernels to break and cut the hulls and then the hold on the jaw changed and the milk and meat scraped out with the sharp edge that is nearest the chin. The writer secured one of these jaws in 1903 for the American Museum of Natural History. It is entirely probable that the Eries used deer jaws for the same purpose, as they were Iroquois and closely related to the Senecas. The Senecas have a name for the jaw when used as an implement of this kind, a name for the process, and called the corn so prepared "already chewed." Figure 27 is a drawing of one of these "jaw corn scrapers."

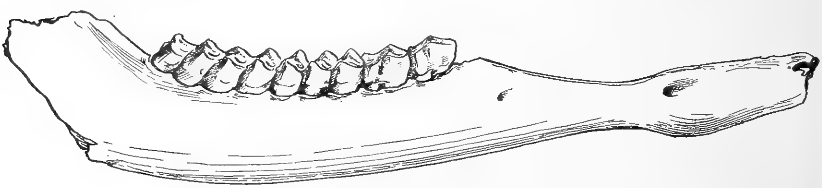


Fig. 27 Deer jaw scraper

A serrated rib from an ash pit is probably an implement of some kind. Its notched edges suggest its employment as a potter's tool. Perhaps it was used to roughen the surface of the clay which was afterward smoothed down [*see* text fig. 23].

Antler

Antler objects were fairly numerous, though not of great variety. Those found in refuse pits were well preserved but those from graves were decayed and crumbling.

The **antler objects** from the site include flaking tools, punchlike implements, sometimes called pitching tools, chisellike implements, picklike prongs of antler, arrowheads, hoes or digging implements and 1 antler ball. There were several pieces of antler showing marks of cutting and other working. The large trowellike object shown in plate 35, figure 1, is probably an antler hoe or spade. The edge is worn and smoothed, evidently by use in the earth. Two other hoes are shown in the same plate [fig. 5, 10]. The larger hoe seems to have had one side cut as if by a metal knife. The "hoes" are all of moose horn. A small chisellike implement is shown in plate 35, figure 2. It is worn and polished and the cutting edge is sharp for such material. A larger chisel or pick is shown in plate 35, figure 4, and seems to have the handle whittled into shape by a metal knife. Punchlike objects were fairly common and seem to have been parts of an arrow maker's outfit. Indeed they are commonly called "pitching tools" and experiment shows that they are useful in making the long body chips which must sometimes be made to properly form a flint blade. These tools are of two types. Plate 35, figure 9, shows one which has a head. Two antler arrowheads were found. Plate 35, figure 8, represents the better one. It is well shaped and polished but the hole for the shaft is not deep. One flattened ball was found and is similar to the game balls used now by the Iroquois and called "deer horn buttons" [*see* pl. 35, fig. 6]. Chunks or pieces of worked antler were frequent. One shown in figure 17 is that of an antler base from which the upper part has been cut with a metal knife.

Shell articles

Among the interesting classes of articles are those of shell. The very interesting necklace of shell shown in plate 14 is the best specimen of art in shell found at the Ripley site. It came from grave XCIII, pit 133, and was found about the neck of the skeleton. The better preserved gorget was found in the bend formed by the curve of the front portion of the lower jaw. The necklace is made of discoidal shell beads beautifully made. They are quite uniform and the perforations are perfectly centered. In specimens which have not weathered the edges are even. The two gorgets and the long pendant from this necklace are shown in plate 36 as is a series of discoidal beads illustrating the stages of disintegration. A perforated Unio shell was found in pit 46 and a shell bead of the older form came from pit 3 [*see* pl. 36, fig. 5].

Copper articles and objects preserved by copper

With the exception of one specimen all copper articles came from graves. An analysis of these articles by the mineralogist Mr H. P. Whitlock indicated that they were all of European copper. The two arm bands contained traces of zinc.

Most of the copper articles came from grave LI, pit 96, and a description of them as they were found will be found under that head. The two bracelets which encircled the arm of the skeleton are shown in plate 37, figures 1, 2. These bands yet retain upon their corroded surfaces the impressions of the skin of the arm against which they rested, although the pictures do not show them well. Finger prints are noticeable on several of the rings and one has the tactile impression on the inner side. Figures 5 and 10 of plate 37 are of two rings which have these impressions upon them. These rings are of the common rolled type made from bands of sheet copper. The arm band fragment shown by plate 37, figure 4, is a fine specimen of rolled copper work.

In graves where copper was present the animal or vegetable matter in immediate contact was preserved by the copper salts. The substances so preserved include wood, bark, herbs, deer hair, deerskin, thongs, human skin, flesh, bone, nails, hair and scalp fragments.

Figure 3 in plate 37 is that of a rolled copper bead which yet contains the skin thong. Pieces of bark and deerskin massed together are pictured in plate 37, figure 7. The shreds of bark are plainly visible but the skin does not show well. In the same plate figure 11 is a piece of wood preserved by the salts of copper from the ring that encircles the opening. The form of the object suggests a false-face eye. Plate 37, figure 9, is that of a mass of vegetable matter, possibly some herb or tobacco.

Iron

But few pieces of iron were found. Of those discovered in graves or ash pits none bore the semblance of finished or complete utensils. In a few graves and in one ash pit short rectangular bars were found and with them chunks of flint, probably parts of fire-making apparatus. In grave XCIII a portion of a small ax, adz or chisel edge was found. It had been broken at a perforation.

Carbonized substances

Vegetable matter preserved by carbonization was found in nearly all of the ash pits but so crushed as to be unrecognizable. Charred

wood and bark were found in quantities in most of the pits and the pieces varied in size from small particles to chunks five inches in length and an inch or two in diameter. Charred corn in small quantities was found in several refuse pits and seems to have been the ordinary variety found in most Iroquoian sites. A few beans, squash seeds, hickory nuts, butternuts and plum stone in a charred condition complete the list of the foods preserved by carbonization. Charred corn was found in several of the graves and in one grave the decayed handle of a celt was found. Charred bark and wood were frequent in the graves and fragments of what seemed a bark dish were found in one grave. A long wooden stem, probably a pipe stem, was found in an ash pit and a few minutes afterward a clumsy visitor stepped upon the box in which it was temporarily placed and crushed most of it. A small section, however, remained.

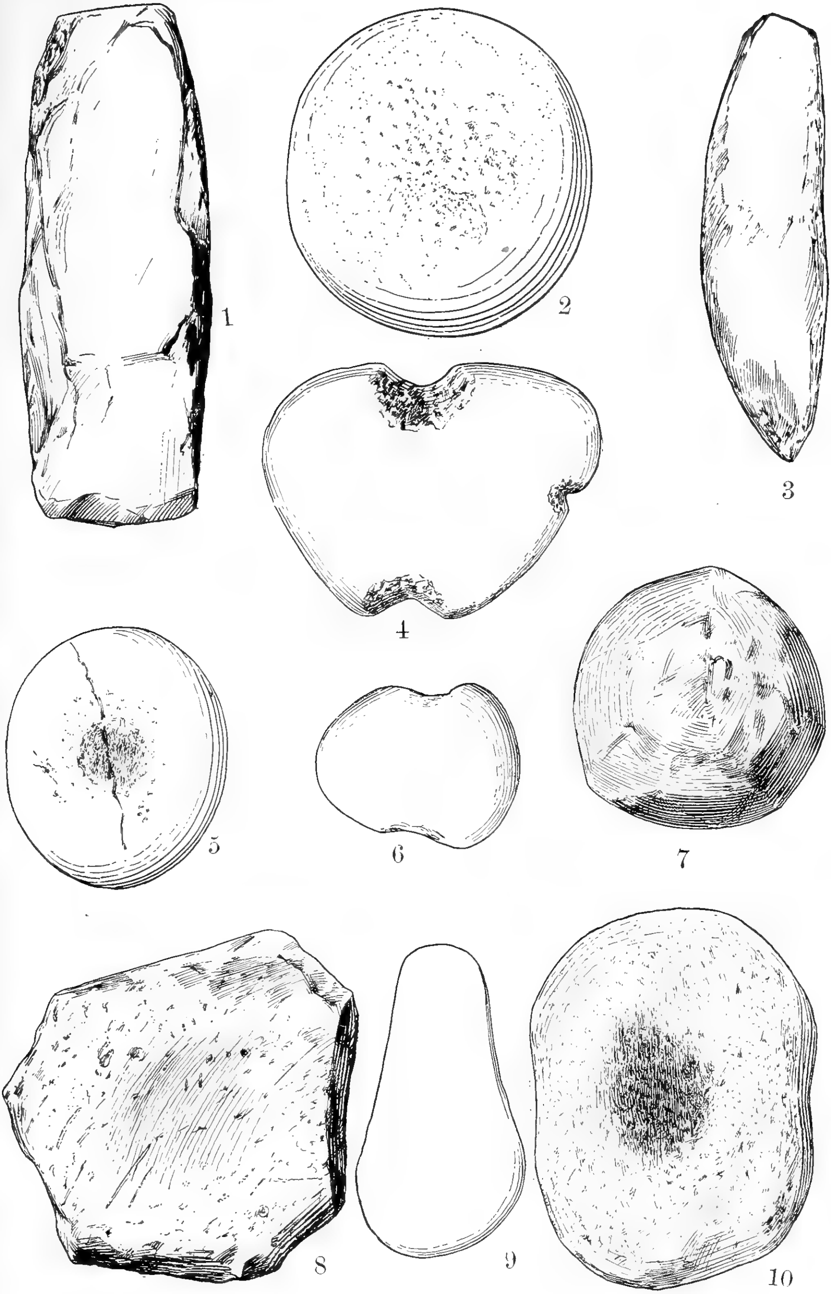
Pigments

The pigments were ochers, graphite and bitumen or asphaltum. Charcoal may also be included. Quantities of red ocher were found in some of the graves and some skeletons lay in deposits of it. In other graves the ocher was in little deposits as if it had been inclosed in a bag that had afterward decayed.

Articles found in vicinity

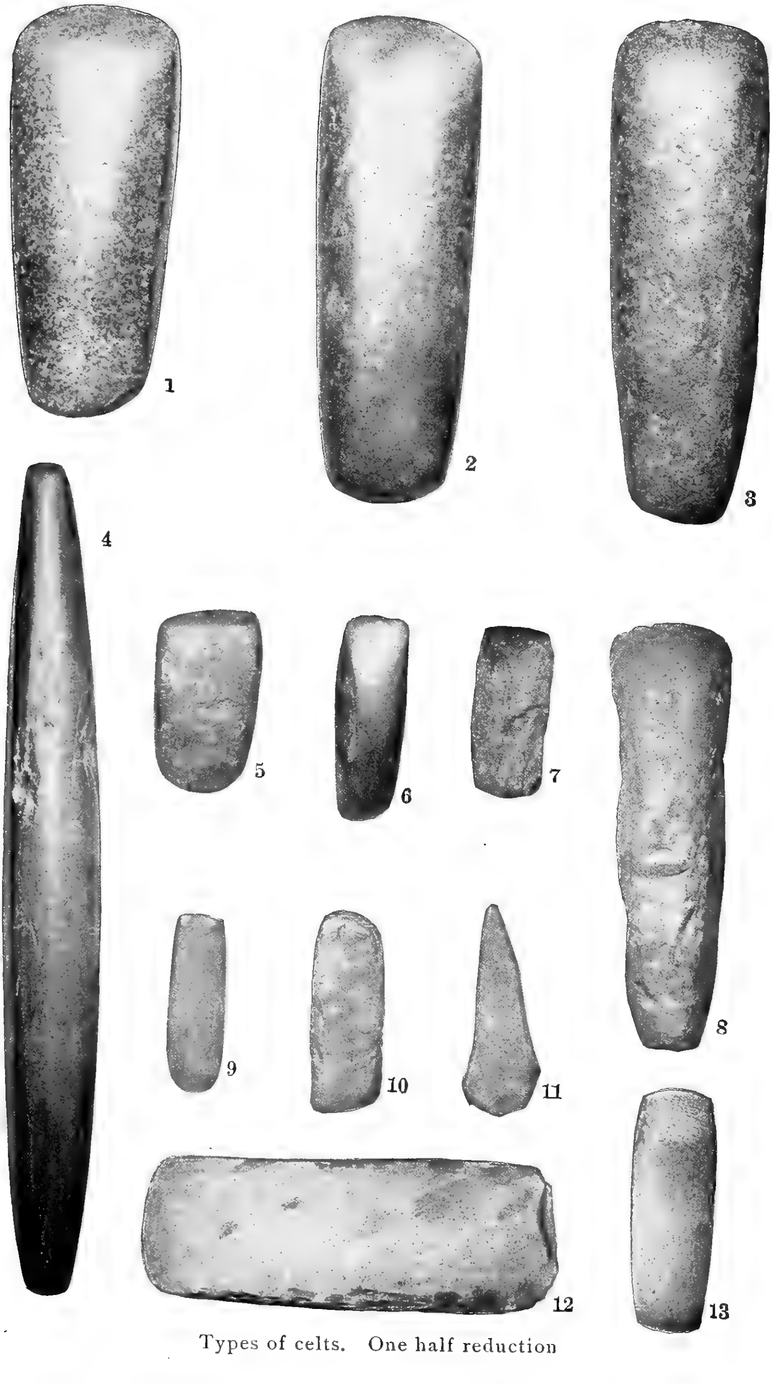
Objects which are found in the vicinity of Ripley but which were not found on the site are the following: Of the older occupations: gouges, grooved axes, mica plates, inscribed stones, monitor pipes, banner stones, bird shaped stones, gorgets, tubular shell beads, etc.; and of the later occupations: notched and shouldered arrow points and spears, shell beads in numbers, wampum, iron tomahawks, lead objects, copper or brass arrow points, glass beads, etc.

Plate 19



Types of rude stone implements improvised from natural pebbles, the shape of which required only slight modification to adapt them for the purposes intended. 1=Hoe or rude celt. 2=Hammer. 3=Pick. 4, 6=Net sinkers. 5=Pitted hammer stone. 7=Hammer. 8=Anvil and grinding base. 9=Smoother. 10=Pitted hammer stone and small anvil

Plate 20

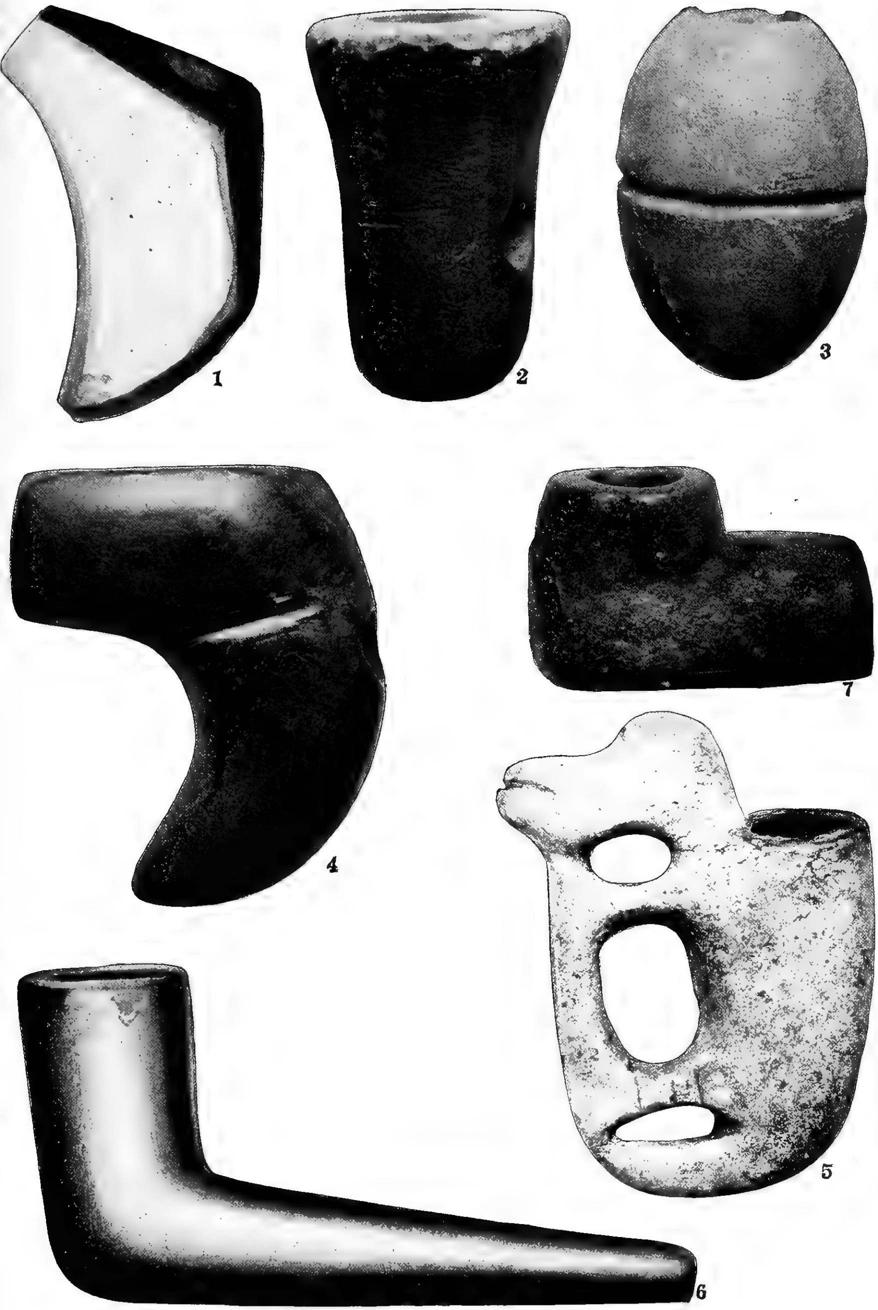


Types of celts. One half reduction

Plate 21

Stone press for pressing juice from fruits and berries. This unique specimen is from the William A. Spear collection and was found at Ripley

Plate 22

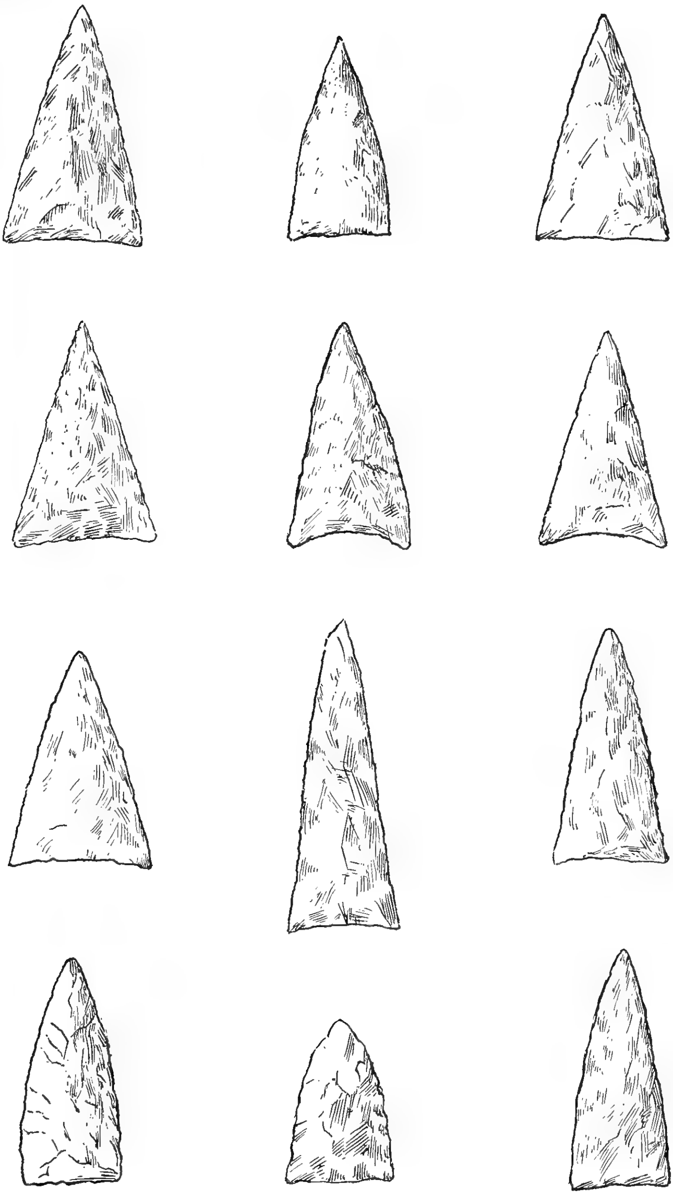


Stone pipes. 1, 2 and 3 are from the topsoil or general occupied layer; 4, 5, 6 and 7 are from graves

Plate 23

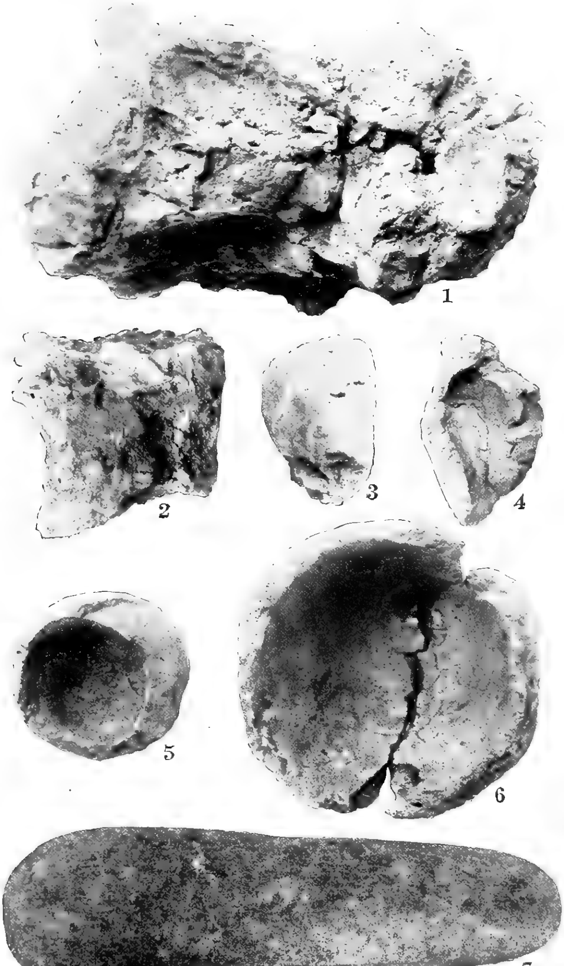
Types of chipped flint implements not arrow points. Figures 4 and 11 are scrapers and 7 is a rude drill. See also text figure 21

Plate 24



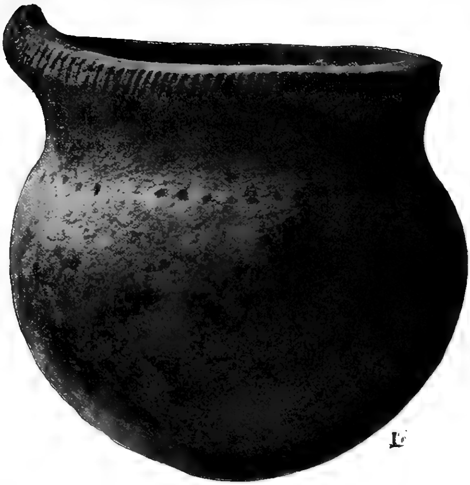
Range of size and form of the triangular flint arrow heads

Plate 25



Clay in process. Figures 1 and 2 are clay masses containing pulverized granite and yet bear the finger inpressions of the potter. Figure 3 is a short section of a coil. Figure 4 is that of a rude pipe bowl fragment. 5 and 6 are toy bowls from pit 96. 7 is probably a potter's paddle

Plate 26



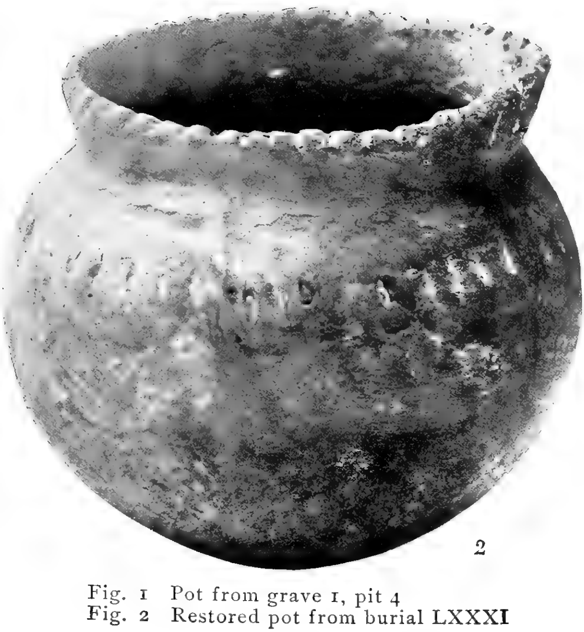
1

2

Pots with raised rim points. From graves

Plate 27

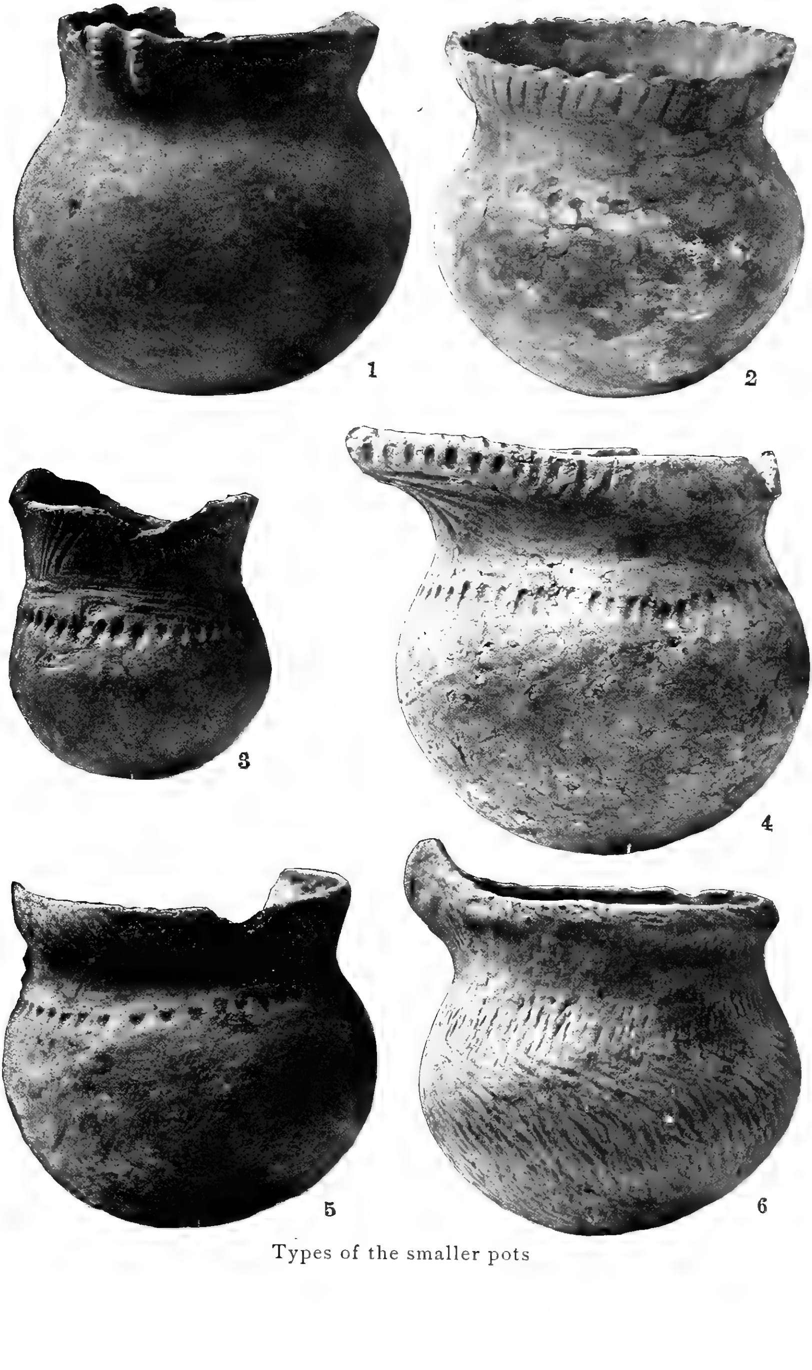
1



2

Fig. 1 Pot from grave 1, pit 4
Fig. 2 Restored pot from burial LXXXI

Plate 28



Types of the smaller pots

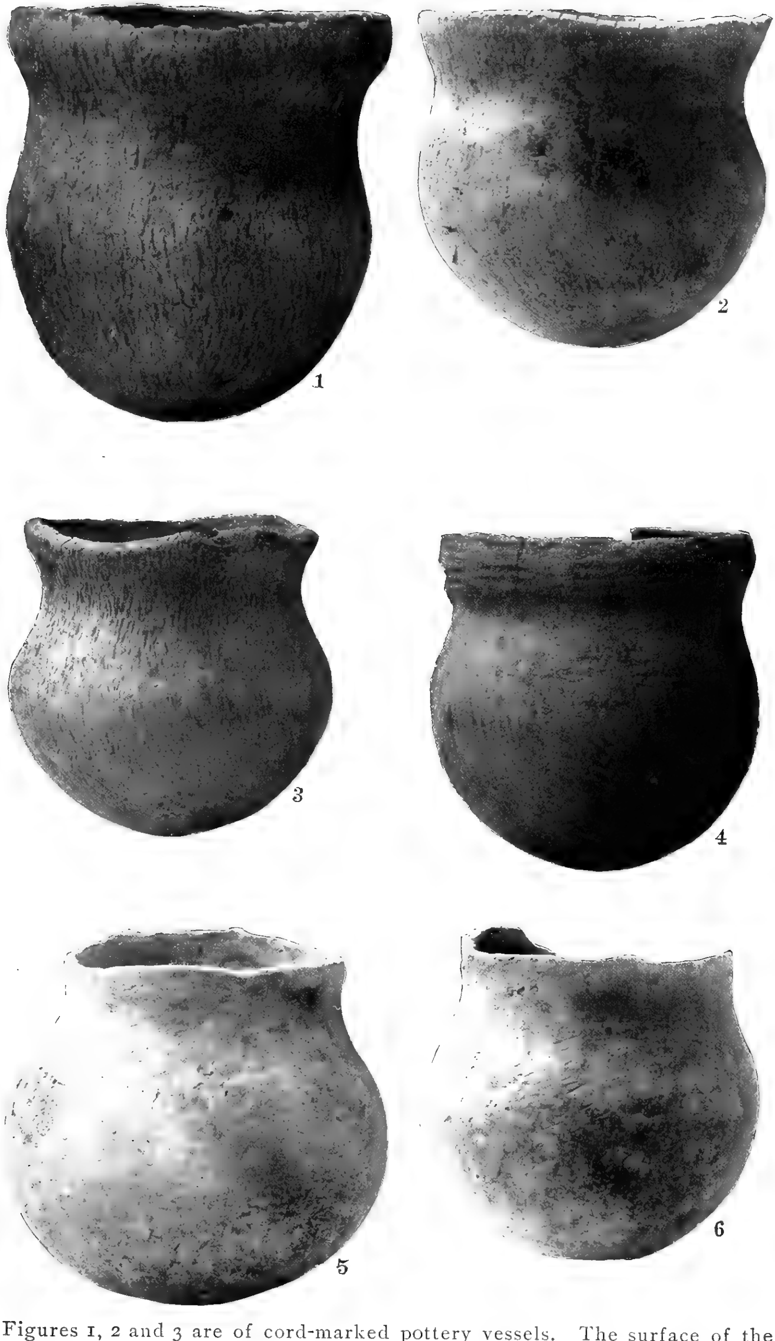
Plate 29

1

2

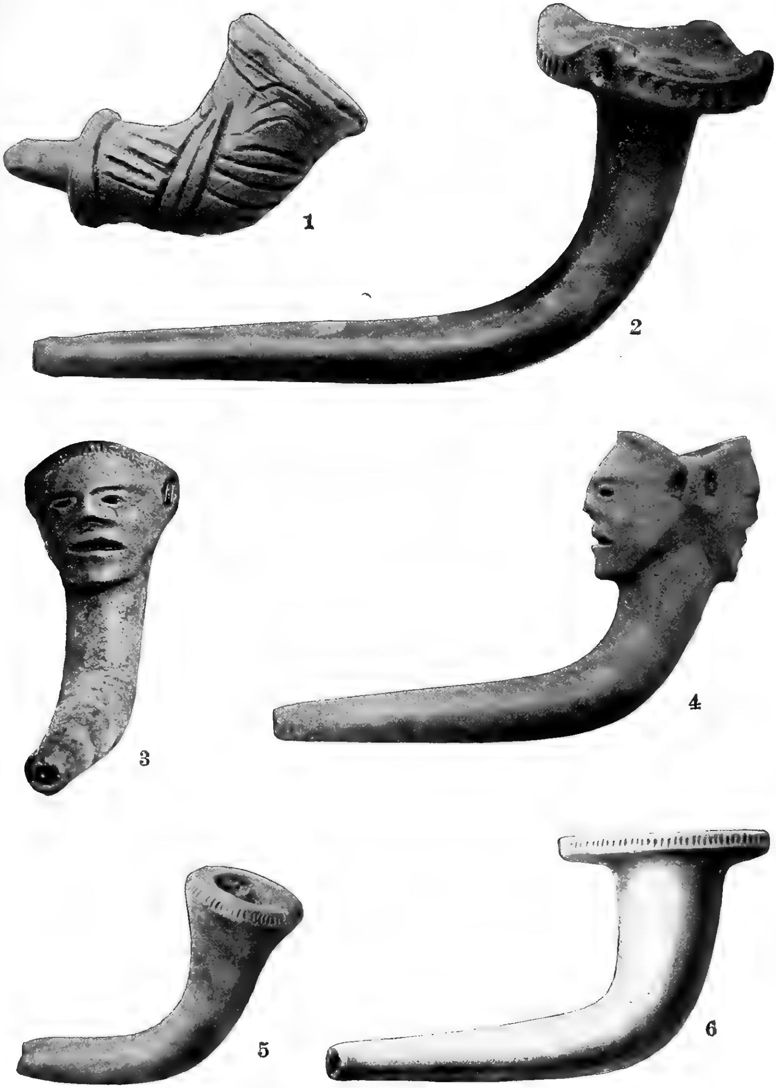
Types of plain and decorated pots having a raised point or lip on the rim

Plate 30



Figures 1, 2 and 3 are of cord-marked pottery vessels. The surface of the pot shown in figure 4 seems to have been marked with a brush of twigs. Figures 5 and 6 are of plain pottery

Plate 31

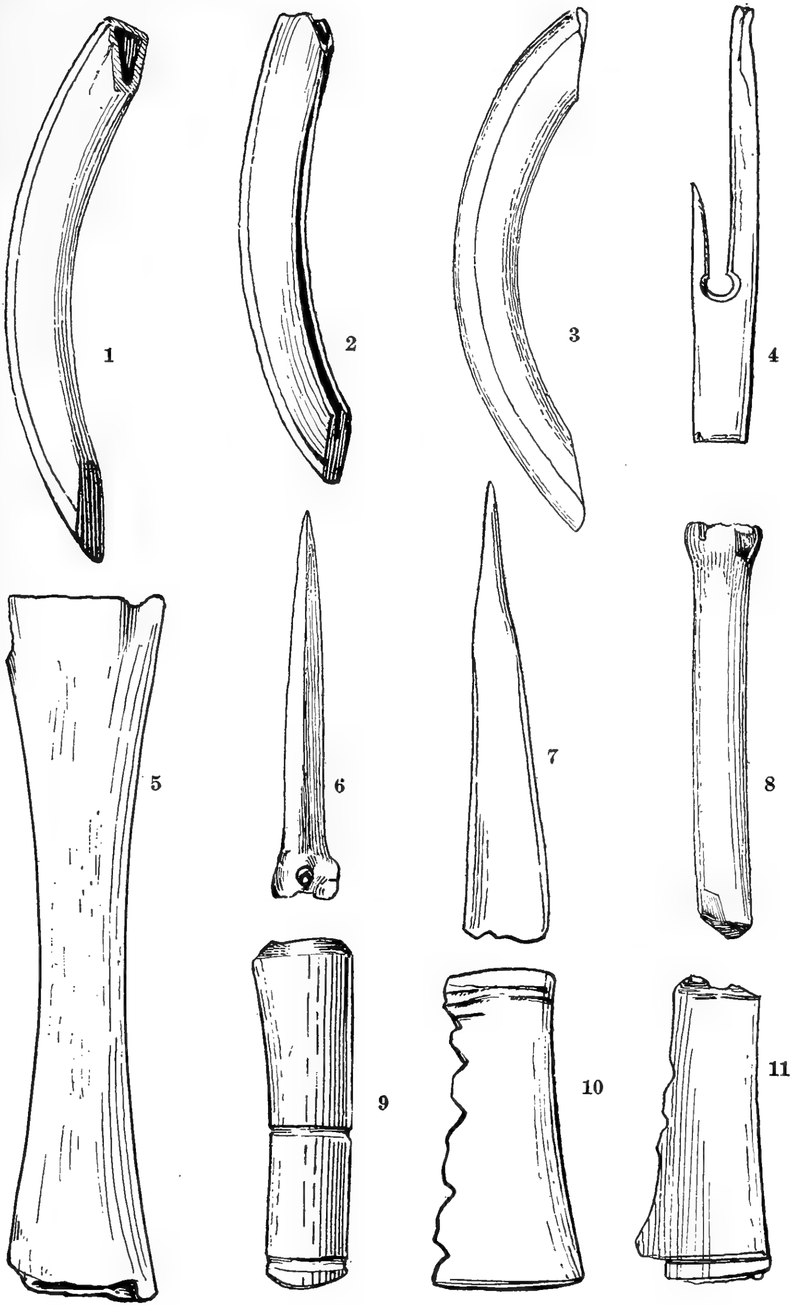


Pottery pipes from graves. 1 is a massive clay pipe bowl decorated with deeply incised lines and has a stem that might serve either for a mouthpiece or as a nipple over which a stem of wood might be inserted. 2 is from grave XXV and is the so called Huronian type. 3 and 4 are two views of the two faced pipe from grave XX. 5 is a trumpet pipe from grave XX. 6 is a flat round topped trumpet pipe from grave LXXV. All these pipes contain charred tobacco as when found

Plate 32

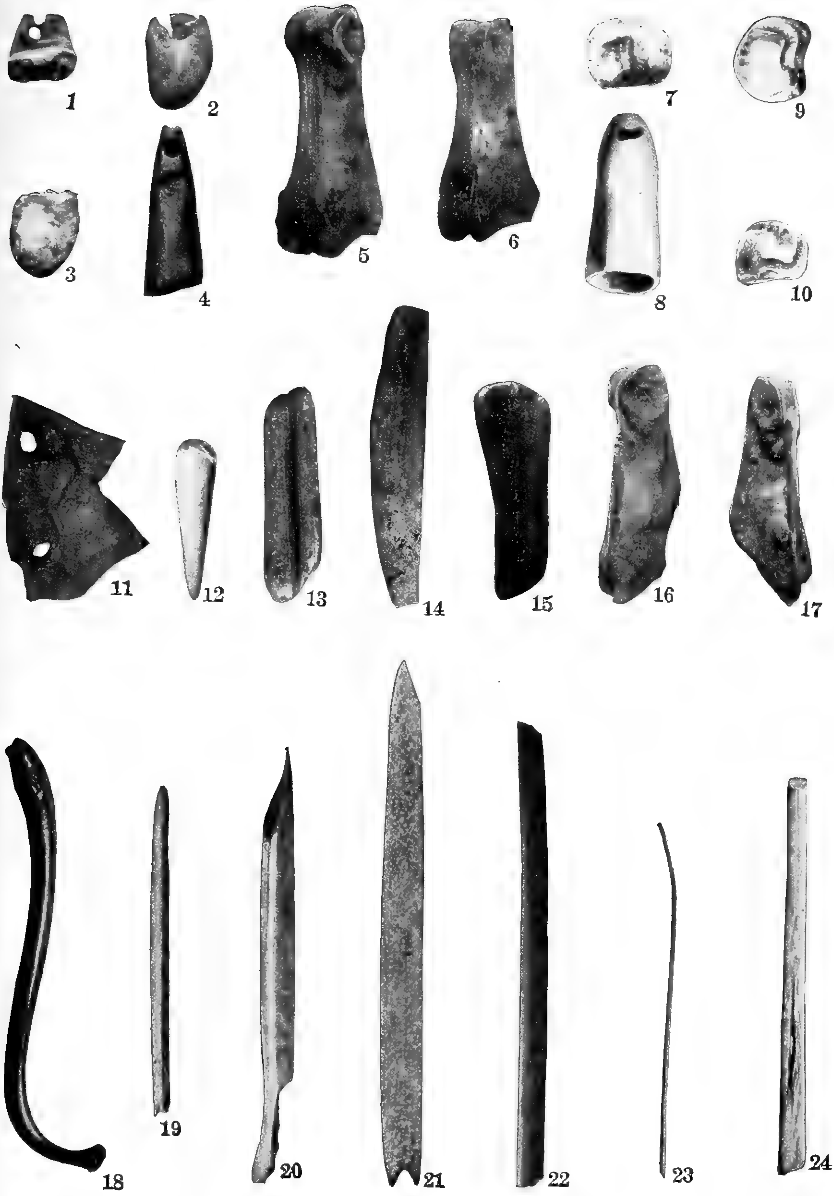
Types of bone awls from ash and refuse pits

Plate 33



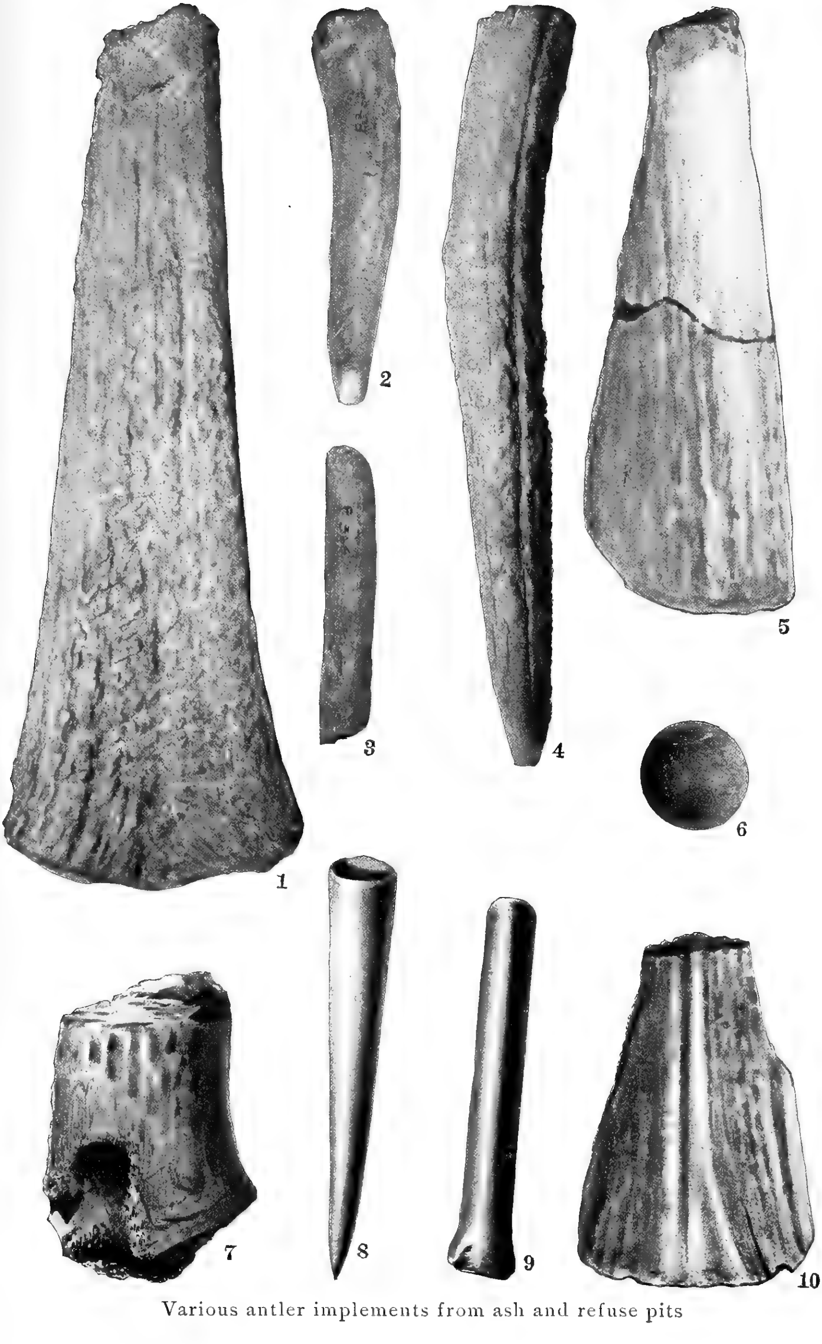
Various bone implements from refuse and fire pits

Plate 34



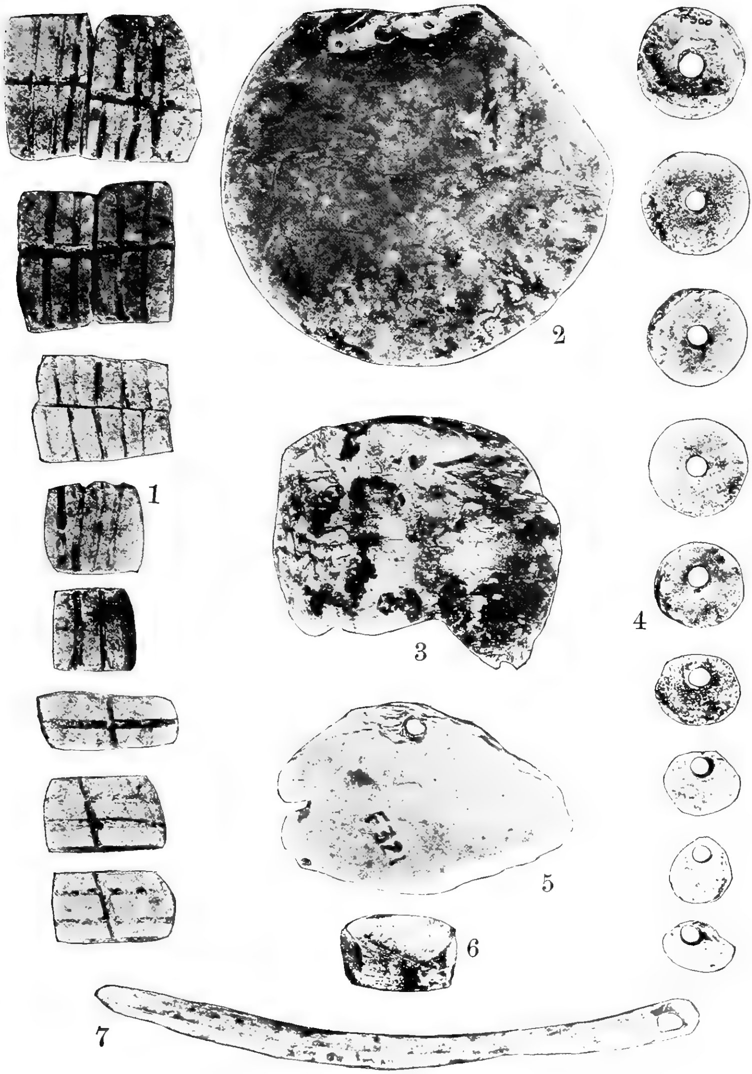
Various bone implements from refuse and fire pits

Plate 35



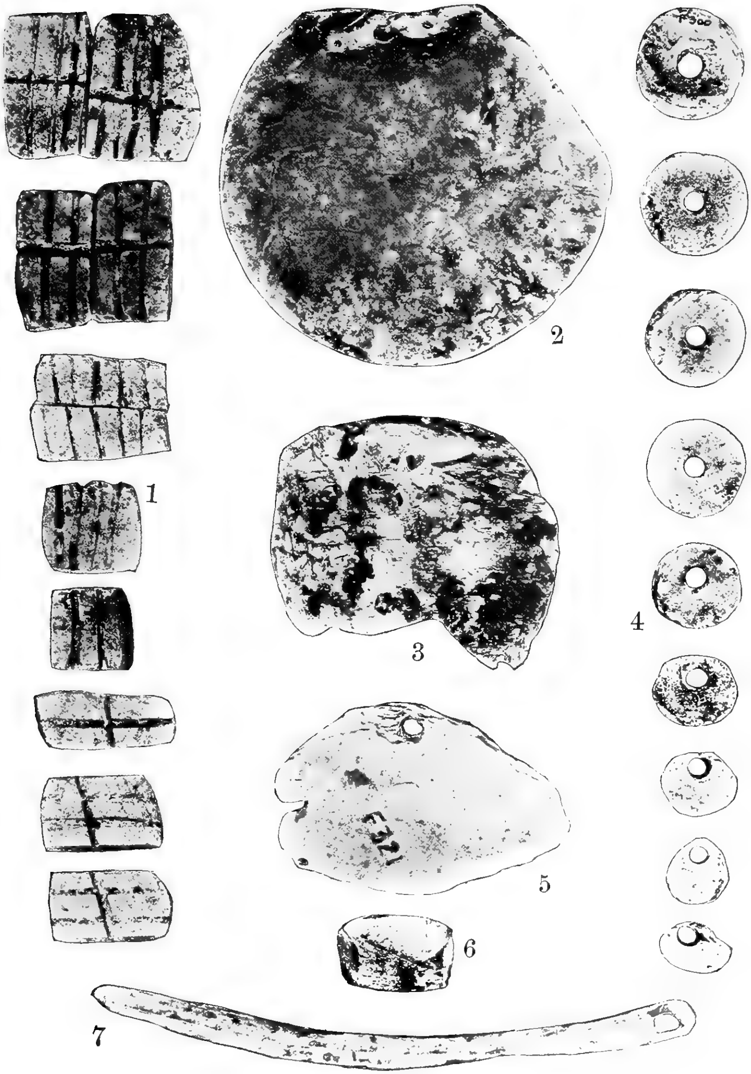
Various antler implements from ash and refuse pits

Plate 36



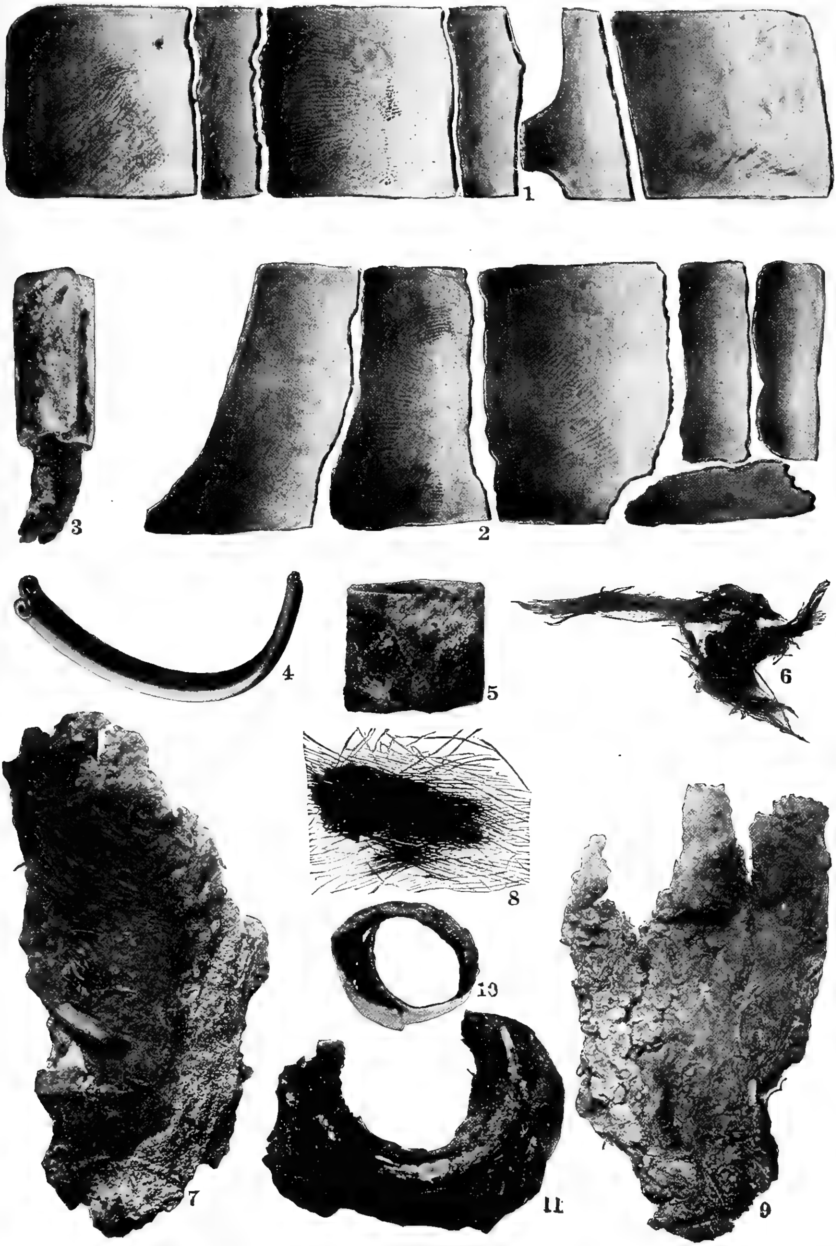
Shell articles principally from graves

Plate 36



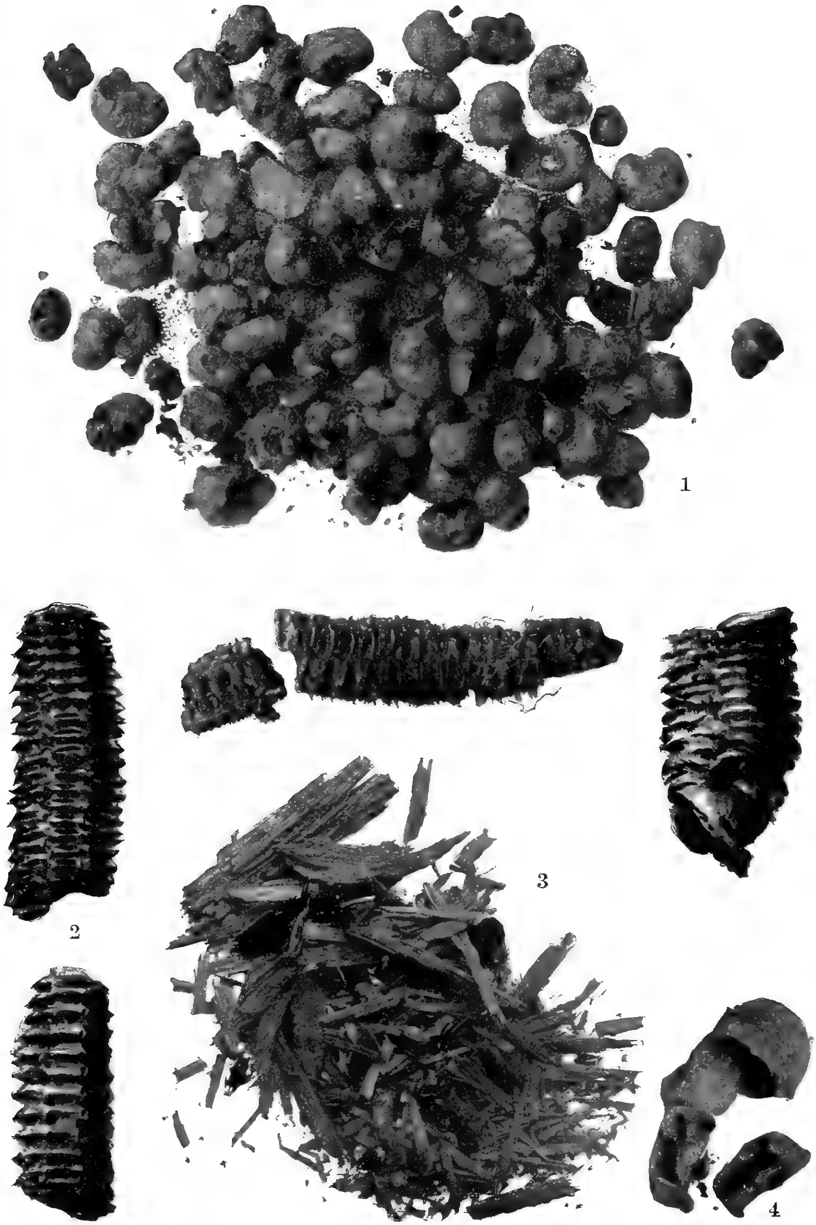
Shell articles principally from graves

Plate 37



Copper articles and articles preserved by contact with copper. 1, 2= Broken bracelets of copper from grave LI. They yet show the impressions of the human skin against which they lay. 3= A bead in which is a portion of a skin thong. 4= A portion of a copper bracelet. 5= A ring from grave LI. 6= Deer hair from grave LI. 7= Bark and deer skin from grave LI. 8= Portion of human scalp and hair from grave XC. 9= Mass of herbs from grave LI. 10= Ring from grave XC. 11= Wood preserved by copper ring

Plate 38



Vegetable matter preserved by carbonization. Figure 3 is that of a mass of decayed resinous wood

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New York State Education Department

New York State Museum

JOHN M. CLARKE, Director

PUBLICATIONS

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Museum annual reports 1847–date. *All in print to 1892, 50c a volume, 75c in cloth; 1892–date, 75c, cloth.*

These reports are made up of the reports of the Director, Geologist, Paleontologist, Botanist and Entomologist, and museum bulletins and memoirs, issued as advance sections of the reports.

Director's annual reports 1904–date.

These reports cover the reports of the State Geologist and of the State Paleontologist. Bound also with the museum reports of which they form a part.

Report for 1904. 138p. *20c.* 1905. 102p. 23pl. *30c.* 1906. 186p. 41pl. *35c.*

Geologist's annual reports 1881–date. Rep'ts 1, 3–13, 17–date, O; 2, 14–16, Q.

In 1898 the paleontologic work of the State was made distinct from the geologic and was reported separately from 1899–1903. The two departments were reunited in 1904, and are now reported in the Director's report.

The annual reports of the original Natural History Survey, 1837–41, are out of print.

Reports 1–4, 1881–84, were published only in separate form. Of the 5th report 4 pages were reprinted in the 39th museum report, and a supplement to the 6th report was included in the 40th museum report. The 7th and subsequent reports are included in the 41st and following museum reports, except that certain lithographic plates in the 11th report (1891) and 13th (1893) are omitted from the 45th and 47th museum reports.

Separate volumes of the following only are available.

Report	*Price*	*Report*	*Price*	*Report*	*Price*
12 (1892)	$.50	17	$.75	21	$.40
14	.75	18	.75	22	.40
15, 2v.	2	19	.40	23	.45
16	1	20	.50	[*See* Director's annual reports]	

Paleontologist's annual reports 1899–date.

See first note under Geologist's annual reports.

Bound also with museum reports of which they form a part. Reports for 1899 and 1900 may be had for 20c each. Those for 1901–3 were issued as bulletins. In 1904 combined with the Director's report.

Entomologist's annual reports on the injurious and other insects of the State of New York 1882–date.

Reports 3–20 bound also with museum reports 40–46, 48–58 of which they form a part. Since 1898 these reports have been issued as bulletins. Reports 3–4, 17 are out of print, other reports with prices are:

Report	*Price*	*Report*	*Price*	*Report*	*Price*
1	$.50	9	$.25	15 (En 9)	$.15
2	.30	10	.35	16 (" 10)	.25
5	.25	11	.25	18 (" 17)	.20
6	.15	12	.25	19 (" 21)	.15
7	.20	13	.10	20 (" 24)	.40
8	.25	14 (En 5)	.20	21 (" 26)	.25
				22 (" 28)	.25

Reports 2, 8–12 may also be obtained bound separately in cloth at 25c in addition to the price given above.

Botanist's annual reports 1867–date.

Bound also with museum reports 21–date of which they form a part; the first Botanist's report appeared in the 21st museum report and is numbered 21. Reports 21–24, 29, 31–41 were not published separately.

Separate reports for 1871–74, 1876, 1888–96 and 1898 (Botany 3) are out of print. Report for 1897 may be had for 40c; 1899 for 20c; 1900 for 50c. Since 1901 these reports have been issued as bulletins [*see* Bo 5–9].

Descriptions and illustrations of edible, poisonous and unwholesome fungi of New York have also been published in volumes 1 and 3 of the 48th (1894) museum report and in volume 1 of the 49th (1895), 51st (1897), 52d (1898), 54th (1900), 55th (1901), in volume 4 pf the 56th (1902), in volume 2 of the 57th (1903) and in volume 4 pf the 58th (1904) reports. The descriptions and illustrations of edible and unwholesome species contained in the 49th, 51st and 52d reports have been revised and rearranged, and, combined with others more recently prepared, constitute Museum memoir 4.

Museum bulletins 1887–date. O. *To advance subscribers,* **$2** *a year or* **$1** *a year for division* (1) *geology, economic geology, paleontology, mineralogy;* 50c *each for divisions* (2) *general zoology, archeology and miscellaneous,* (3) *botany,* (4) *entomology.*

Bulletins are also found with the annual reports of the museum as follows:

Bulletin	*Report*	*Bulletin*	*Report*	*Bulletin*	*Report*	*Bulletin*	*Report*
G 1	48, v. 1	Pa 2, 3	54, v. 3	En 11	54, v. 3	Ar 3	52, v. 1
2	51, v. 1	4	" v. 4	12, 13	" v. 4	4	54, v. 1
3	52, v. 1	5, 6	55, v. 1	14	55, v. 1	5	" v. 3
4	54, v. 4	7–9	56, v. 2	15–18	56, v. 3	6	55, v. 1
5	56, v. 1	10	57, v. 1, pt 1	19–22	57, v. 1, pt 2	7	56, v. 4
6	57, v. 1, pt 1	11–14	58, v. 3			8, 9	57, v. 2
7–10	58, v. 1	Z 3	53, v. 1			9	" v. 2
Eg 5, 6	48, v. 1	4	54, v. 1			10, 11	58, v. 4
7	50, v. 1	5–7	" v. 3	23, 24	58, v. 5	Ms 1, 2	56, v. 4
8	53, v. 1	8	55, v. 1	Bo 3	52, v. 1		
9	54, v. 2	9	56, v. 3	4	53, v. 1	*Memoir*	
10	" v. 3	10	57, v. 1, pt 1	5	55, v. 1	2	49, v. 3
11	56, v. 1	11, 12	58, v. 4	6	56, v. 4	3, 4	53, v. 2
12, 13	58, v. 2	En 3	48, v. 1	7	57, v. 2	5, 6	57, v. 3
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3	57, v. 1, pt 1	7–9	53, v. 1	Ar 1	50, v. 1		
Pa 1	54, v. 1	10	54, v. 2	2	51, v. 1		

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